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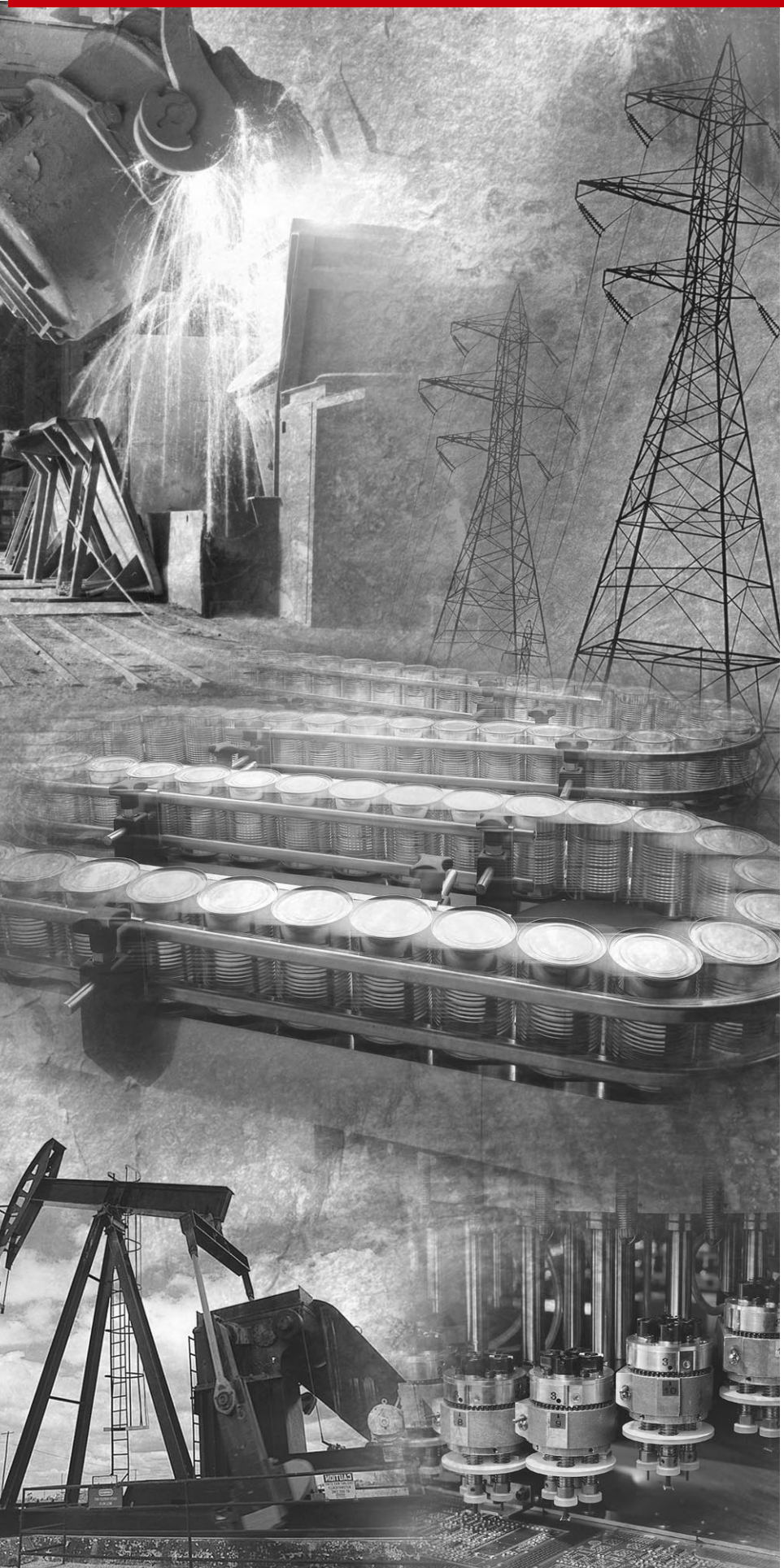

Allen-Bradley

1397 DC Drive

1.5 - 150HP @230VAC
7 - 265ADC @380/415VAC
3 - 600HP @460VAC

Firmware Rev. 2.xx

User Manual

Rockwell Automation

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. "*Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls*" (Publication SGI-1.1 available from your local Allen-Bradley Sales Office or online at **http://www.ab.com/manuals/gi**) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

In no event will the Allen-Bradley Company be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, the Allen-Bradley Company cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Allen-Bradley Company with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual we use notes to make you aware of safety considerations.

ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss.

Attentions help you:

- identify a hazard
- avoid the hazard
- recognize the consequences

Important: Identifies information that is especially important for successful application and understanding of the product.

Shock Hazard labels may be located on or inside the drive to alert people that dangerous voltage may be present.

Summary of Changes

Summary of Changes

Description of New or Updated Information	Page	Type
FS2/FS3 Control Options	1-4	Updated
200% Overload Capacity	1-4	Updated

Table of Contents

Introduction

Chapter 1

Manual Objectives 1-1
Chapter Objective 1-2
Storage Conditions 1-2
Drive Identification Nameplate 1-2
Firmware Version 1-2
Catalog Numbering Convention 1-3
Specifications 1-4
Power Ratings and Supply Capacity (230/460VAC) 1-6
Power Ratings and Supply Capacity (380/415VAC) 1-6
Drive I/O Specifications Logic Inputs 1-7
Logic Outputs 1-7
Analog Inputs 1-8
Analog Outputs 1-8
Drive Description 1-9
Options 1-10

Installation

Chapter 2

Chapter Objectives 2-1
Environment 2-1
Mounting 2-1
Cooling Airflow 2-2
Line Filters (CE Only) 2-2
AC Line Inductors (CE Only) 2-2
Enclosure Mounting Minimum Clearances 2-3
Enclosure Mounting Dimensions 2-4
Grounding Procedures 2-8
Wiring Clearance 2-14
Disconnect 2-14
24V Power Supply 2-14
Wire Size, Type & Class 2-15
Motor Installation 2-17
Power Wiring Procedure 2-17
AC Line Torque Recommendations 2-24
Recommended AC Line and DC Armature Fuses 2-25
Control Connections 2-30
Control Wiring Procedure 2-31

Programming Terminal — Chapter 3

General 3-1
HIM Description 3-1
HIM Operation 3-5
HIM Programming Steps 3-6
HIM Programming Modes 3-7
Program and Display Modes 3-7
Bit ENUMS 3-7
Process Mode 3-8
EEprom Mode 3-9
Search Mode 3-12
Control Status Mode 3-12

Start–Up and Adjustment — Chapter 4

Introduction 4-1
Required Tools and Equipment 4-2
Recommended Tools and Equipment 4-2
General 4-2
Drive Hardware Adjustments 4-3
Motor Ground Check 4-6
Pre–Power Checks 4-6
Pre–Power Checklist 4-7
Field Supply Configuration 4-8
Power–On Checks 4-14
Parameter Set–Up 4-15
Parameter Modification Sequence 4-17
Jumper Settings 4-20
Verify the Correct Operation of 24V I/O Inputs 4-26
Motor and Feedback Polarity Checks 4-29
Autotuning 4-35
Auto–Tune Set–Up 4-36
Auto–Tune Execution 4-37
Application Set–Up 4-38

Programming Parameters — Chapter 5

Introduction 5-1
Record Keeping 5-1
Safety Precautions 5-2
Parameter Groups 5-2
Numeric Parameter Table 5-6
Parameter Descriptions (By Group) 5-14
Parameters (Alphabetical) 5-97
Hidden Parameters 5-100

Troubleshooting

Chapter 6

Introduction 6-1
Required Equipment 6-1
HIM Fault Display 6-2
Clearing a Fault 6-2
Clearing an Alarm 6-2
Fault Description Table 6-3
Alarm Description Table 6-7

Firmware Block Diagram

Appendix A

Standard Inputs A-1
I/O Expansion Inputs A-2
Speed/Trim Reference Select A-3
Speed Reference Ramp A-4
Outer Control Loop A-5
Speed Reference Mode Select A-6
Speed Loop A-7
Current Minor Loop Reference A-8
Current Minor Loop A-9
Field Control Loop A-10
Standard Outputs A-11
Level Detectors A-12
I/O Expansion Outputs A-13

CE Conformity

Appendix B

EMC Compliance B-1
EMC Requirements B-1
Equipment Requirements B-1
Mounting the Equipment B-4
Grounding Requirements B-8
Wiring the Equipment B-10

Derating

Appendix C

High Ambient Temperature Conditions C-1
Derating for High Altitude C-2
Air Conditioning C-2
Space Heaters C-2

Using SCANport Capabilities

Appendix D

Chapter Objectives D-1
Logic Status Parameter D-1
Configuring the SCANport Controls D-3
Setting the Loss of Communications Fault D-5
Using the SCANport I/O Image D-5
Supported SCANport Messages D-11
Logic Status Format D-12
Logic Command Format D-12
User Parameter Value Table D-13

Lifting Instructions

Appendix E

Introduction E-1
Lifting Component Ratings E-1
Drive Mounting E-1

Introduction

Manual Objectives

The purpose of this manual is to provide you with the necessary information to install, program, start up and maintain the 1397 DC Drive. This manual should be read in its entirety before operating, servicing or initializing the 1397 Drive. This manual must be consulted first, as it will reference other 1397 manuals for option initialization.

This manual is intended for qualified service personnel responsible for setting up and servicing the 1397 DC Drive. You must have previous experience with and a basic understanding of electrical terminology, programming procedures, required equipment and safety precautions, as typical applications will consist of a properly rated DC motor, with or without feedback based on performance requirements, and the 1397.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of this equipment and the hazards involved should install, adjust, operate and/or service this equipment. Read and understand this section in its entirety before proceeding. Failure to observe this precaution could result in bodily injury or loss of life.

ATTENTION: An incorrectly installed or applied drive can result in component damage or a reduction in product life. Wiring or application errors such as undersizing the motor, incorrect or inadequate AC supply or excessive ambient temperatures may result in damage to the Drive or motor.

ATTENTION: This drive contains ESD (Electrostatic Discharge) sensitive parts and assemblies. Static control precautions are required when installing, testing, servicing or repairing this assembly. Component damage may result if ESD control procedures are not followed. If you are not familiar with static control procedures, reference Allen–Bradley Publication 8000 – 4.5.2, *Guarding against Electrostatic Damage* or any other applicable ESD protection handbook.

Chapter Objective

Chapter 1 in addition to detailing drive features and specifications, also supplies the information needed to unpack, properly inspect and if necessary, store the 1397 Drive. A complete explanation of the catalog numbering system is also included in this chapter.

Storage Conditions

After receipt inspection, repack the Drive in its original shipping container until ready for installation. To ensure satisfactory operation at startup and to maintain warranty coverage, store the Drive as follows:

- In its original shipping container in a clean, dry, safe place.
- In an ambient temperature that does not exceed 65°C (149°F) or go below -30°C (-22°F).
- Within a relative humidity range of 5 to 95% without condensation.
- At an altitude of less than 3,000 meters (10,000 ft.) above sea level.

Drive Identification Nameplate

The 1397 DC Drive has a nameplate on the side of the chassis (Fig. 1.1) that identifies the specific model number design, applicable AC input power and DC output power data. All communication concerning this product should refer to the appropriate model number information.

Figure 1.1
Bulletin 1397 Nameplate

BULLETIN 1397
M/N 1397-BO10R 5/10HP
INPUT 230/460VAC 19A 3PH 50/60HZ
OUTPUT 240/500VDC 20A
DC FIELD 150/300VDC 10A
SHORT CIRCUIT RATING 5000A
I/M 1397-5.0 W/D 30371–23

FOR 230V OPERATION, SEE I/M
SERIAL NO. 1397-B010R V 001 WY
MADE IN USA

The technical power information on the nameplate should be referenced to verify proper power application.

Firmware Version

The manual covers firmware versions through 2.xx.

Catalog Numbering Convention

Drive specific data, such as horsepower (or output current), regenerative or non-regenerative type, line voltage etc. can be determined by the Drive model number. The model number structure is shown below.

1397– B005 – OPTIONS

1397 –	B		005		R	– OPTIONS
First Position Bulletin Number	Second Position Voltage		Third Position Rating		Fourth Position Type	Fifth Position
1397	**Letter**	**Voltage**	**Rating**	**HP (kW)**	**N = Non Regen**	
	A	230V AC	001	1.5 (1.1)	**R = Regen**[1]	–DS
			002	2 (1.5)		–MB
			003	3 (2.2)		–L10
			005	5 (3.7)		–L11
			007	7.5 (5.8)		–DB
			010	10 (7.5)		–FS2
			015	15 (11)		–FS3
			020	20 (15)		–PE
			025	25 (18)		–AC
			030	30 (22)		
			040	40 (29)		–HAB
			050	50 (37)		–HAP
			060	60 (44)		–HA1
			075	75 (55)		–HA2
			100	100 (74)		
			125	125 (93)		1203–GD1
			150	150 (111)		1203–GD2
	U	380/415V AC	ADC	380/415		1203–GK1
			7	2.4 (1.8)/2.8 (2.1)		1203–GK2
			29	12 (9)13.8 (10.3)		1203–GK5
			55	24 (17.9)/27.6 (20.8)		
			110	48 (35.8)/55.2 (41.2)		
			265	120 (89.5)/138 (102.9)		NOTE: Refer to page 1–4 for additional option information.
	B	460V AC	003	3 (2.2)		
			005	5 (3.7)		
			007	7.5 (5.6)		
			010	10 (7.5)		
			015	15 (11)		
			020	20 (15)		
			025	25 (18)		
			030	30 (22)		
			040	40 (29)		
			050	50 (37)		
			060	60 (44)		
			075	75 (55)		
			100	100 (74)		
			125	125 (93)		
			150	150 (111)		
			200	200. (149)		
			250	250 (186)		
			300	300 (224)		
			400	400 (298)		
			500	500 (373)		
			600	600 (448)		

1 Regen (R) required for reversing applications

1397 – OPTIONS

CONTROL OPTIONS

–DS	AC Line Disconnect
–MB	Blower Motor Starter
–L10	Control Interface – 115VAC
–L11	I/O Expansion Cord
–DB	Dynamic Braking
–FS3	Enhanced Field Supply
–FS2	Field Current Regulator
–PE	Pulse Encoder Kit
–AC	AC Tachometer Kit
–IFB	(400 – 600 HP only)

COMMUNICATION OPTIONS (Loose Kits)

–1203–GD1	Single Point Remote I/O (RIO) – 115V AC
–1203–GD2	RS–232/422/485, DF1 and DH485 Protocol – 115VAC
–1203–GK1	Single Point Remote I/O (RIO) – 24 VDC
–1203–GK2	RS–232 Interface Brd
–1203–GK5	DeviceNet – 24 VDC

HUMAN INTERFACE OPTIONS

–HAB	Blank – No Functionality
–HAP	Programmer Only
–HA1	Programmer / Controller with Analog Pot
–HA2	Programmer / Controller with Digital Pot

OPTION CROSS REFERENCE

380/415VAC	460VAC
7A	3 HP
29A	15 HP
55A	30 HP
110A	60 HP
265A	150 HP

Specifications

Input Voltage and Frequency Ratings

Nominal Voltage	207 to 253 V AC or 414 to 506 V AC (Horsepower-rated drives) 342 to 437 V AC or 374 V AC to 477 V AC (Current-rated drives)
Nominal Line Frequency	50 or 60 cycles per second
Frequency Variation	± 2 cycles of nominal

AC Line Fault Capacity

Allowable AC Line Symmetrical	(See Power Ratings and Supply Capacity)

AC Line kVA

AC Line Distribution Capacity	Maximum 3 drives per transformer
Minimum Source kVA	(See Power Ratings and Supply Capacity)

DC Voltage Ratings

230 V AC Line	
Armature Voltage	240 V DC
Field Voltage (w/basic fld supply)	150 V DC
380/415 V AC Line	
Armature Voltage	400/460 V DC
Field Voltage (w/basic fld supply)	250/270 V DC
460 V AC Line	
Armature Voltage	500 V DC
Field Voltage (w/basic fld supply)	300 V DC

Service Factor Ratings

Service Factor	1.0 Continuous
Overload Capacity (drive only)	150% of full load rating for one minute 200% of full load rating for 13 seconds
Minimum Load	5% of rated load

Service Conditions

Ambient Temperature	
Chassis	55°C (131°F) maximum
Cabinet	40°C (104°F) maximum
Altitude	
Chassis and Cabinet	3300 feet above sea level
Above 3300 feet	Derate 3% for every 1000 ft above 3300 ft up to 10000 ft.
Humidity	
Chassis and Cabinet	5 to 95% non-condensing
Environment	The drive should be located in an area that is free of dust, dirt, acidic or caustic vapors, vibration and shock, temperature extremes, and electrical or electromagnetic noise interference.

Regulation

Tachometer Speed Regulation

Regulation Arrangement	Speed Change with 95% Load Change	Speed Change from All other Variables	Kit Model Number
Armature voltage regulation w/IR Compensation	2-3 %	15%	Standard
Closed Loop			
(DC Tach Feedback)	1%	2%	Standard
(Pulse Encoder Feedback) [1]	0.01%	0.01%	1397 – PE
(RD–120 Pulse Encoder FDBK) [1]			

[1] Optional pulse encoder feedback kit required.

Speed Change

Operator's Speed Adjustment	0 to rated speed
Specification Speed Range	100:1 based on top speed and tachometer

Drive Efficiency

Drive Only	98.6% (rated load and speed)
Drive and Motor	85% typical

Note: Typical percent shown depends on motor operating speed and frame size.

Power Ratings

Displacement Power Factor	88% typical (rated load and speed)

Note: Typical percent shown depends on motor operating speed and frame size.

Power Ratings and Supply Capacity (230/460VAC)

HP	Full Load Rated RMS AC Line Current (Amperes)		Full Load Rated DC Armature Current (Amperes)		Rated Field Current (Amperes)		Power Source Capacity [1] (Amperes)		Minimum Source kVA
	230 V AC	460 V AC	240 V DC	500 V DC	150 V DC	300 V DC	230 V AC	460 V AC	
1.5	10	-	7	-	10	-	5000	-	4
2	11	-	9	-	10	-	5000	-	5
3	13	10	12	6	10	10	5000	5000	6
5	19	12	20	10	10	10	5000	5000	7.5
7.5	26	15	29	14	10	10	5000	5000	11
10	33	18	38	19	10	10	5000	5000	15
15	48	24	55	27	10	10	5000	5000	20
20	63	31	73	35	15	10	10000	5000	27
25	80	39	93	45	15	10	10000	5000	34
30	94	45	110	52	15	10	10000	5000	40
40	125	63	146	73	15	15	25000	10000	51
50	154	74	180	86	15	15	25000	10000	63
60	186	86	218	100	15	15	25000	10000	75
75	226	110	265	129	15	15	25000	25000	93
100	307	143	360	167		15		25000	118
125	370	177	434	207		15		25000	145
150	443	213	521	250		15		25000	175
200		281		330		15		30000	220
250		351		412		15		30000	275
300		421		495		15		30000	330
400		567		667		15		75000	440
500		680		800		15		75000	550
600		816		960		15		75000	660

ATTENTION: When applying 1397 Drives to a power distribution system with KVA capacity in excess of five times the smallest drive rating the use of an isolation transformer or line reactors of similar impedance is required. Also, the Drives are designed for a maximum of three units per transformer.

1 Maximum permissible available symmetrical RMS fault current.

Power Ratings and Supply Capacity (380/415VAC)

380 VAC KW/HP	415 VAC KW/HP	380/415 Full Load Rated RMS AC Line Current Amperes	380/415 Full Load Rated DC Armature Current Amperes	Rated Field Current	Power Source Capacity (Amperes)
1.8/2.4	**2.1/2.8**	10	7	10	5,000
9/12	**10.3/13.6**	**26**	**29**	10	5,000
17.9/24	**20.6/27.6**	**48**	**55**	**10**	5,700
35.8/48	**41.2/55.2**	**94**	110	15	11,500
89.5/120	**102.9/138**	**226**	**265**	**15**	25,000

Drive I/O Specifications
Logic Inputs

The following sections describe drive inputs and outputs. Refer to Chapter 3 for terminal strip connections and wiring diagrams.

Logic Inputs

ATTENTION: Connecting an external power source to any of the +24 volt connections (terminals 1, 7, 11, and 14) on the regulator board terminal strip will damage the drive. Do not connect the external power source to the +24 volt connections on the regulator board terminal strip. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The logic input circuits can be powered either from the internal +24 VDC power supply or from an external +24 VDC power source. The internal +24 VDC power supply is available at the regulator board terminal strip (see Fig. 2.15). If an external power source is used, only its common must be connected to 24VCOM on the regulator board (terminal 15).

Electrical Specifications

Input Voltage	+24 VDC
Turn On Voltage	+8 VDC
Turn Off Current	0.5 mA
Common	All input circuits have the same common.

Logic Outputs

The logic output circuits are normally open (when de-energized) relay contacts. When energized (contacts closed), the three circuits indicate the following drive conditions. Terminals are on the terminal strip on the regulator board.

Running	Terminal 27 to 28
Alarm	Terminal 29 to 30
No Fault	Terminal 31 to 32

Electrical Specifications

Operating Voltage	250 VAC maximum 30 VDC maximum
Switching Current	2 Amps maximum resistive 1 Amp maximum inductive

Analog Inputs

The three customer analog inputs are Analog Reference 1, Analog Reference 2 and Analog Tachometer Feedback. These inputs are converted within the Drive to 12 bits plus sign at their full range. The electrical specifications for each of these are listed below.

Analog Reference 1 (Terminals 19,20)
(see page 4.25 for J10 & J12 jumper settings)

Voltage Reference	±10 VDC
Milliamp Reference	4-20 mA or 10-50 mA

Analog Reference 2 (Terminals 16, 17, 18)
(see page 4.24 for J19 jumper settings)

Potentiometer	5kΩ minimum
External Voltage Source	±10 VDC 0 to 10 Volts DC

Analog Tachometer Feedback
(see page 4.20 for J11 and J14 jumper settings)

Tach Voltage at Top speed	10 to 250 VDC

Analog Outputs

The two metering analog outputs are available at regulator board terminals 24, 25 and 26. Terminal 25 is the common connection for both output signals. The selected signals for both meter outputs are averaged (filtered) over 100 ms to reduce meter fluctuations.

NOTE: Refer to the Start-Up chapter for information on programming Analog Outputs.

Electrical Specifications

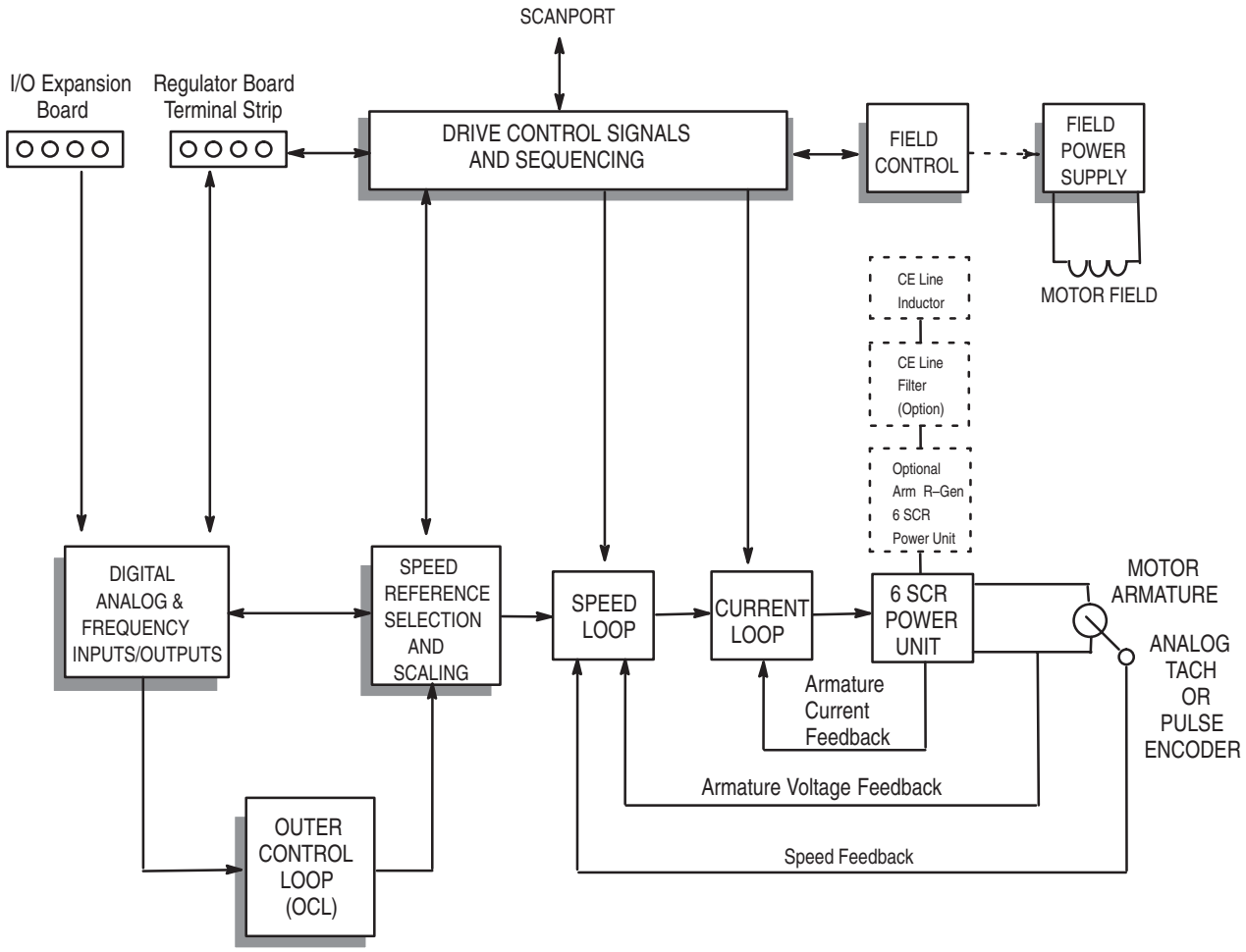
Output Voltage	±10 VDC, 4 mA

Drive Description

The Drive is a 3 phase full-wave power converter without flyback rectifier, complete with a digital current regulator and a digital speed regulator for armature voltage or speed regulation by tachometer feedback. Shown in Figure 1.2 is a block diagram of the 1397 Drive.

The Drive employs wireless regulator construction and uses a keypad for Drive setup, including parameter adjustments and unit selection, monitoring, and diagnostics. Reference, feedback, and metering signals can be interfaced to the Drive. The Drive can be controlled locally by the control device (HIM, GPT, DriveTools etc.) keypad or remotely by using the terminals at the regulator board terminal strip.

Figure 1.2
1397 Block Diagram



Options

Name	Description	I/M Number
115 V AC Control Interface All Horsepowers	Converts customer-supplied 115 V AC signals to 24 V DC for operating a 1397. Mounts separately on the panel or can be mounted in the bottom of a NEMA Type 1 enclosed drive.	1397-5.18
230 V AC Conversion	Allows conversion of the 460 V AC 1397 to a 230 V AC 1397 at one-half the 460 V AC horsepower rating.	1397-5.16
A-C Line Disconnect 3 – 60 HP @ 460V 1 – 30HP @ 230V 7 – 100A @ 380/415VAC	Allows the three-phase line to be disconnected at the drive. Molded case switch that mounts on the chassis of the drive or NEMA Type 1 enclosure.	1397-5.11
Dynamic Braking	Provides the hardware, including braking grids, needed to provide dynamic braking on stop. Supplied in a NEMA Type 1 enclosure. The 1397–DB–A and 1397–DB–B series allow the kit to be panel mounted. These kits include the resistor grid assembly and contactor. The customer must supply fused 115 V AC.	1397-5.15
Enhanced Field Supply	Provides electronic field trim, field economy, and the ability to supply 240V field voltage and other special voltages. This kit replaces the standard field supply.	1397-5.24
Regulated Field Supply Supplied as standard on: 400 – 600HP @ 460V 150HP @ 460V 75 HP @ 230V and up 265 & 521 ADC @ 380/415 VAC	Provides field economy, as well as pre-weakening of the field using a fixed reference or field weakening for above base speed operation. Tachometer feedback is required with this kit. This kit replaces the standard field supply.	1397-5.17
Blower Motor Starter	Provides a fused A-C starter with adjustable overload and interlocking for control of three phase blower motor used to cool the DC motor.	1397-5.20
Expansion I/O Module	Mounts on the 1397 chassis and gives the drive additional analog, frequency, and digital I/O capability.	1397-5.19
Pulse Encoder Interface Card All Horsepowers	Allows for digital pulse encoder speed feedback	1397-5.13
AC Tachometer Interface Card All Horsepowers	Allows for AC tachometer speed feedback	1397-5.22
AC Line Disconnect 75 – 150 HP @ 460V 40 – 75 HP @ 230V	Allows the three phase line to be disconnected at the drive.	1397-5.21
AC Line Disconnect 200 – 300 HP @ 460V 100 – 150 HP @ 230V 521 ADC @ 380/415 VAC	Allows the three phase line to be disconnected at the drive.	1397-5.27
Inverting Fault Circuit Breaker 400–600 HP	Allows high inertia loads on regenerative 1397 drives.	1397-5.29
AC Line Disconnect 400 – 600 HP @ 460V	Allows the three phase line to be disconnected at the drive.	1397-5.30
AC Line Filter Kit 600 HP @ 460V	Allows power transformer greater than 2300V RMS to be applied to the drive.	1397-5.31
Dynamic Braking Resistor Assembly Lifting Instructions 250–600HP	Provides instructions for properly attaching and lifting Dynamic Braking Kits.	1397-5.32

Installation

Chapter Objectives

The following data will guide you in planning the installation of the 1397 Drive. Since most start-up difficulties are the result of incorrect wiring, every precaution must be taken to assure that the wiring is done as instructed.

IMPORTANT: You are responsible for completing the installation, wiring and grounding of the 1397 Drive and for complying with all National and Local Electrical Codes.

ATTENTION: The following information is merely a guide for proper installation. The National Electrical Code and any other governing regional or local code will overrule this information. The Allen-Bradley Company cannot assume responsibility for the compliance or noncompliance to any code, national, local or otherwise for the proper installation of this Drive or associated equipment. A hazard of personal injury and/or equipment damage exists if codes are ignored during installation.

Environment

The Drive must be mounted in a clean, dry location. Contaminants such as oils, corrosive vapors and abrasive debris must be kept out of the enclosure. Temperatures around the Drive must be kept between 0° and 55°C (32°F and 131°F). Humidity must remain between 5% to 95% non-condensing. The Drive can be applied at elevation of 3300 feet (1,000 meters) without derating. The Drive current rating must be derated by 3% for each additional 1,000 feet (300 meters). Above 10,000 feet (3,000 meters), consult the local Allen-Bradley Sales Office.

Mounting

The 1397 Drive is of the open chassis type construction and is designed to allow you to install it in a suitable enclosure. The selection of enclosure type is the responsibility of the user. Dimensions and clearances for the 1397 are detailed in the figures on the following pages.

ATTENTION: Plan Drive installation so that all cutting, drilling, tapping and welding can be done with the Drive removed from the enclosure. The Drive is of the open type construction and any metal debris must be kept from falling into the Drive. Metal debris or other foreign matter may become lodged in the circuitry resulting in component damage.

Cooling Airflow

In order to maintain proper cooling, the Drive must be mounted in a vertical position. Refer to Figure 2.1 for the recommended minimum clearance of each Drive.

The Drive design produces up to a 10°C or 18°F air temperature rise when the Drive is operated at full capacity. Precautions should be taken not to exceed the maximum inlet ambient air temperature of 55°C (131°F). If the Drive is in an enclosed cabinet, air circulation fans or a closed circuit heat exchanger may be required.

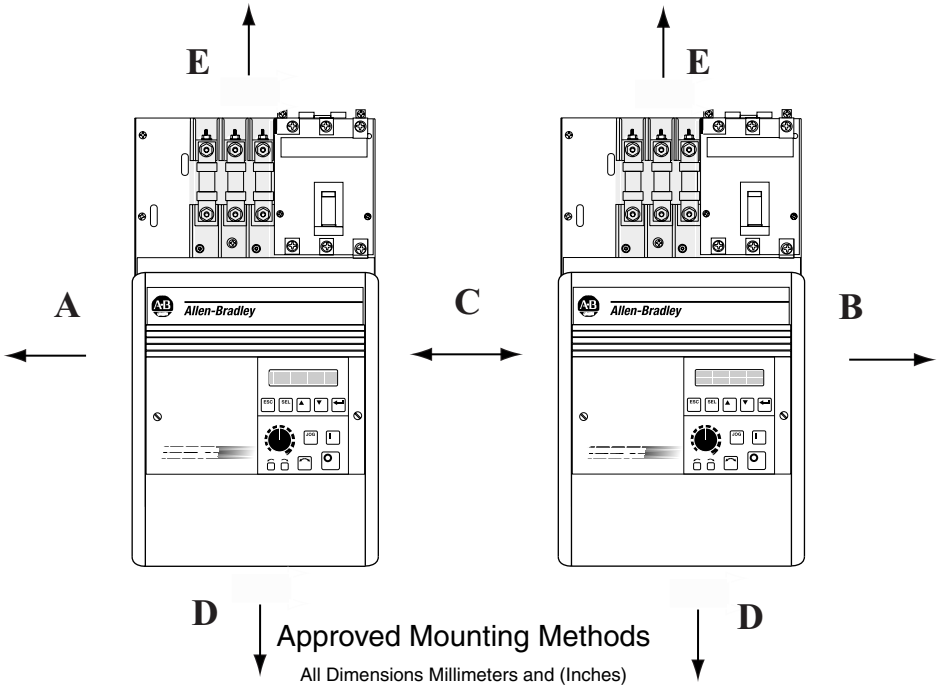
Line Filters (CE Only)

For information on installing, wiring and grounding Line Filters used in CE compliant applications, refer to Appendix B.

AC Line Inductors (CE Only)

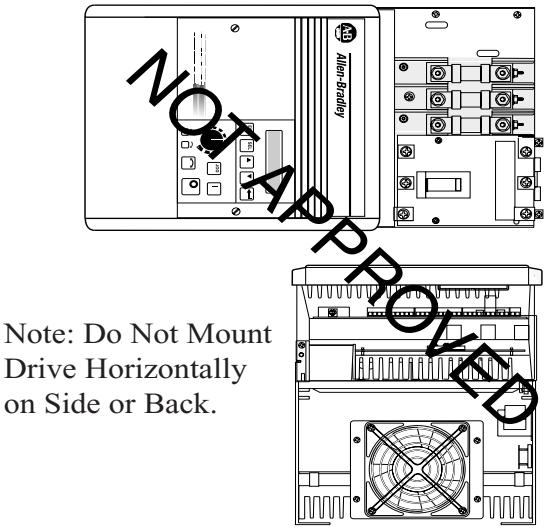
For installation information on AC Line Inductors used in CE compliant applications, refer to Appendix B.

Figure 2.1
Enclosure Mounting Minimum Clearances



Enclosure Mounting Clearances

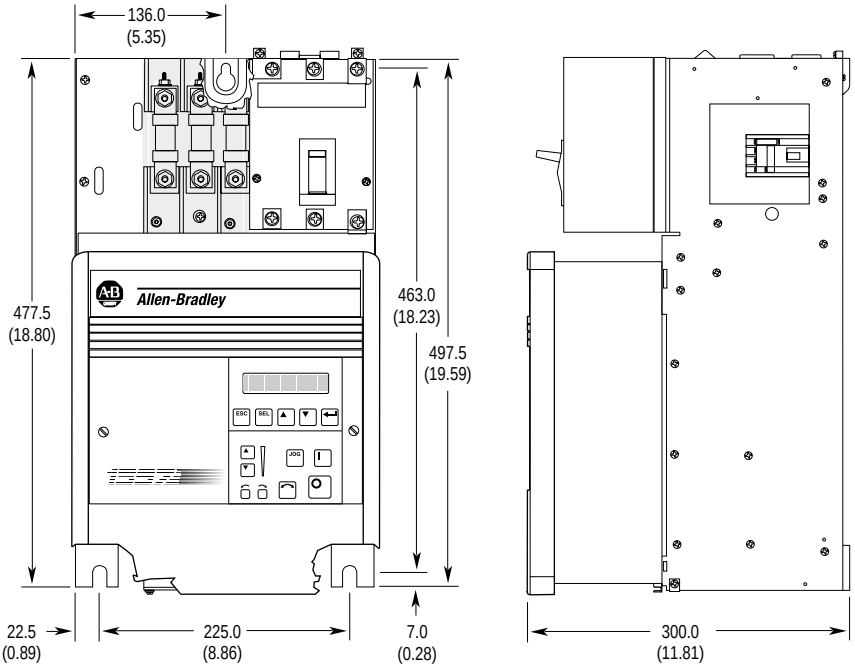
	1.5 – 30 HP @ 230VAC 3 – 60 HP @ 460VAC 7 – 110A @ 380 / 415 VAC	40 – 150 HP @ 230VAC 75 – 600 HP @ 460VAC 265A @ 380 / 415 VAC
A Leftside Clearance	76 mm (3 in.)	76 mm (3 in.)
B Rightside Clearance	51 mm (2 in.)	51 mm (2 in.)
C Drive to Drive Side Clearance	101 mm (4 in.)	101 mm (4 in.)
D Bottom Clearance	127 mm (5 in.)	305 mm (12 in.)
E Top Clearance	127 mm (5 in.)	305 mm (12 in.)



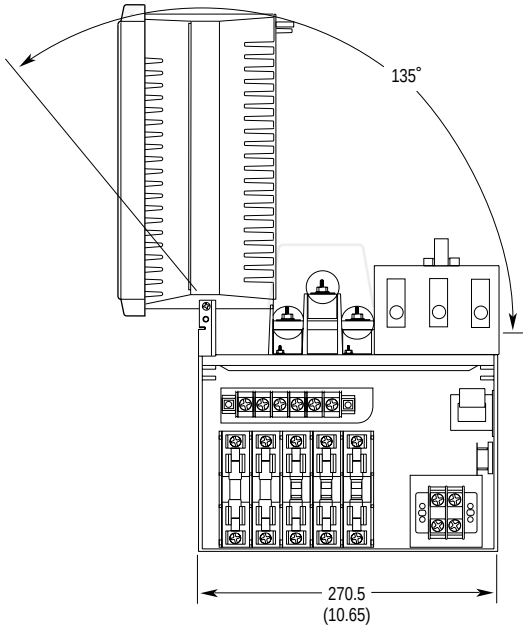
Note: Do Not Mount Drive Horizontally on Side or Back.

Enclosure Mounting Dimensions

Figure 2.2
Drive Mounting Dimensions –
1.5 to 30 HP at 230 VAC
7 to 110A @ 380/415 VAC
3 to 60 HP at 460 VAC



FRONT **SIDE**

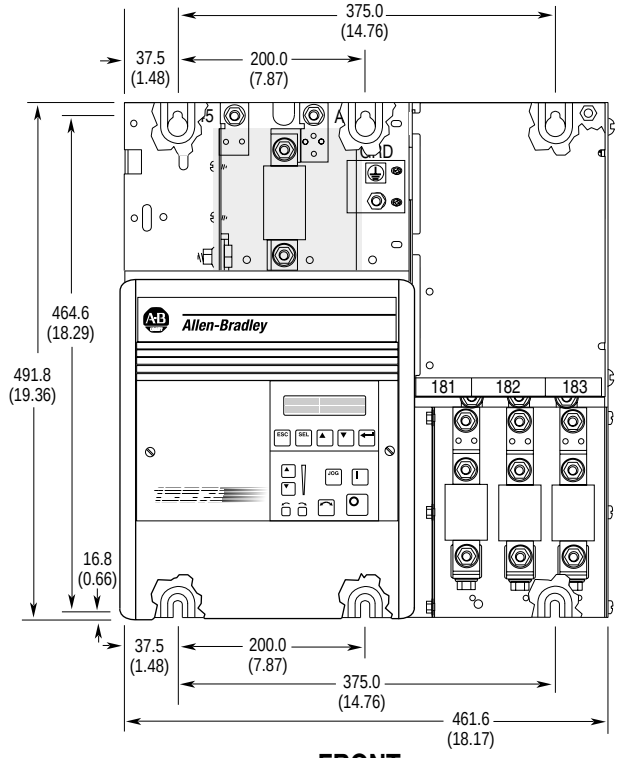


TOP

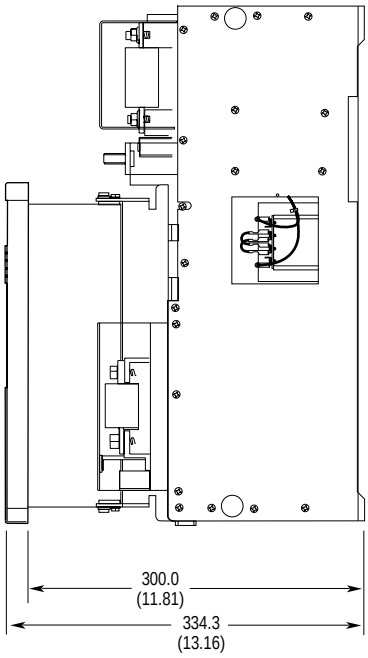
Rec Hardware
3 x M6 or 1/4"

All Dimensions Millimeters and (Inches)
Approximate Shipping Weight 30.8 kg (68 lbs.)

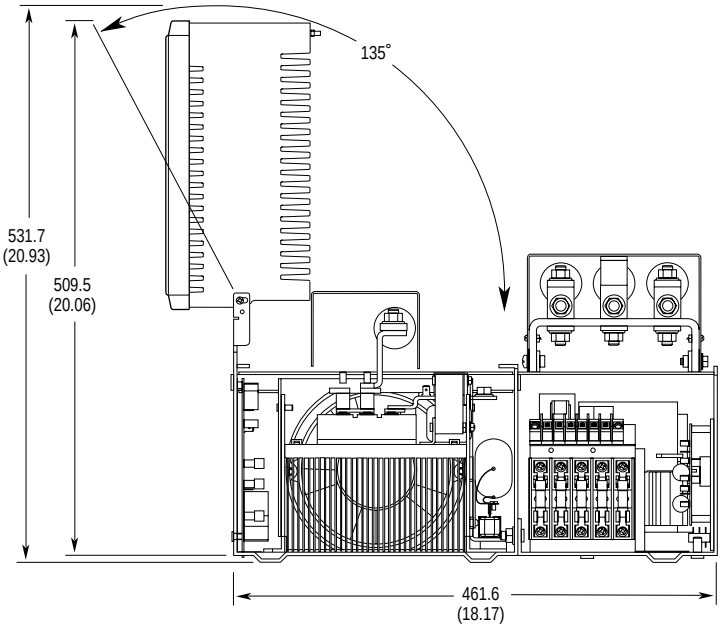
Figure 2.3
Drive Mounting Dimensions –
40 to 75 HP at 230 V AC
265A @ 380/415 VAC
75 to 150 HP at 460 V AC



FRONT



SIDE



TOP

Rec Hardware
6 x M8 or 5/16"

All Dimensions Millimeters and (Inches)
Approximate Shipping Weight 55.0 kg (122 lbs.)

Figure 2.4
Drive Mounting Dimensions – 150 HP at 230 VAC; 200 – 300 HP at 460 VAC

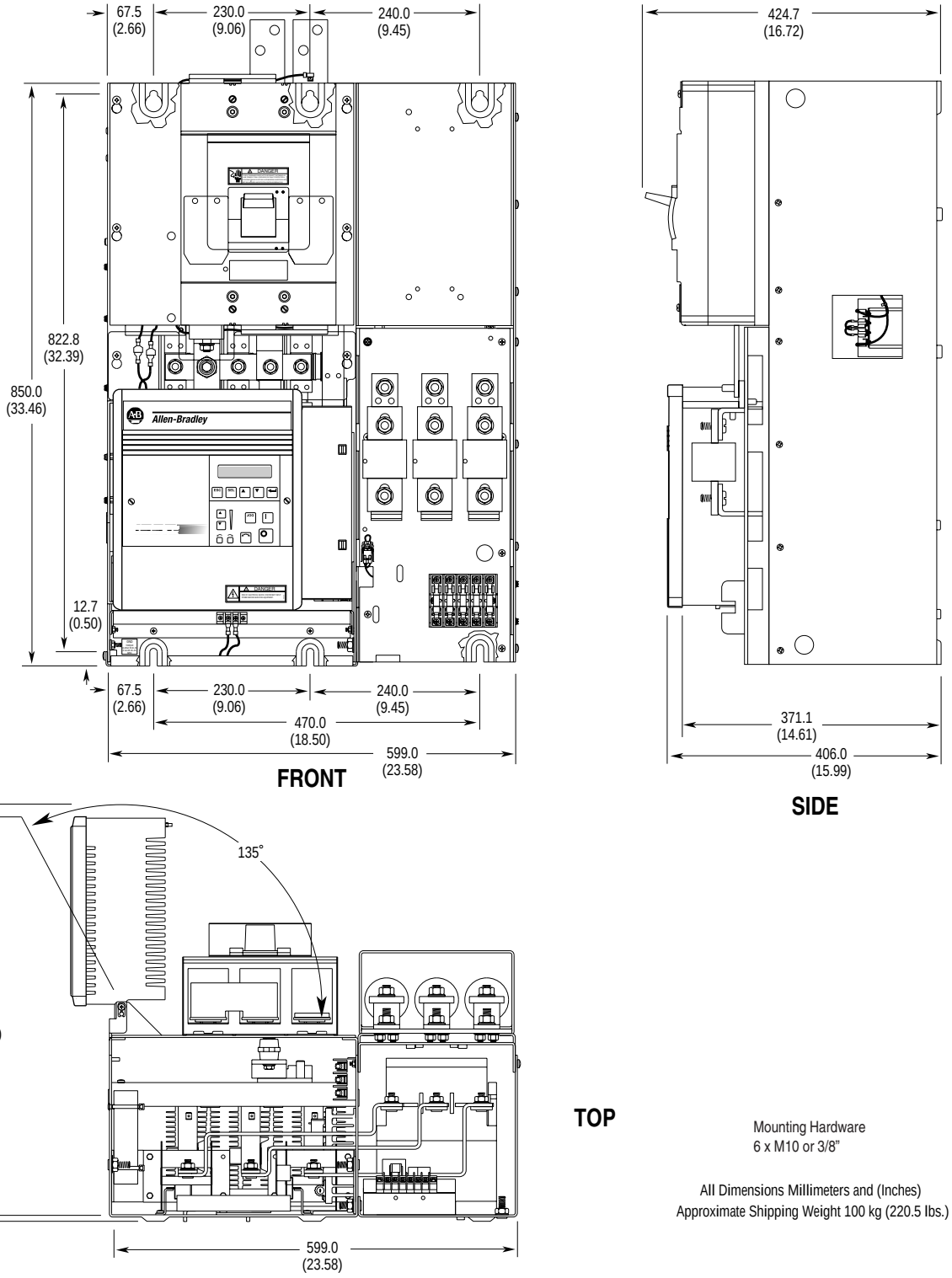
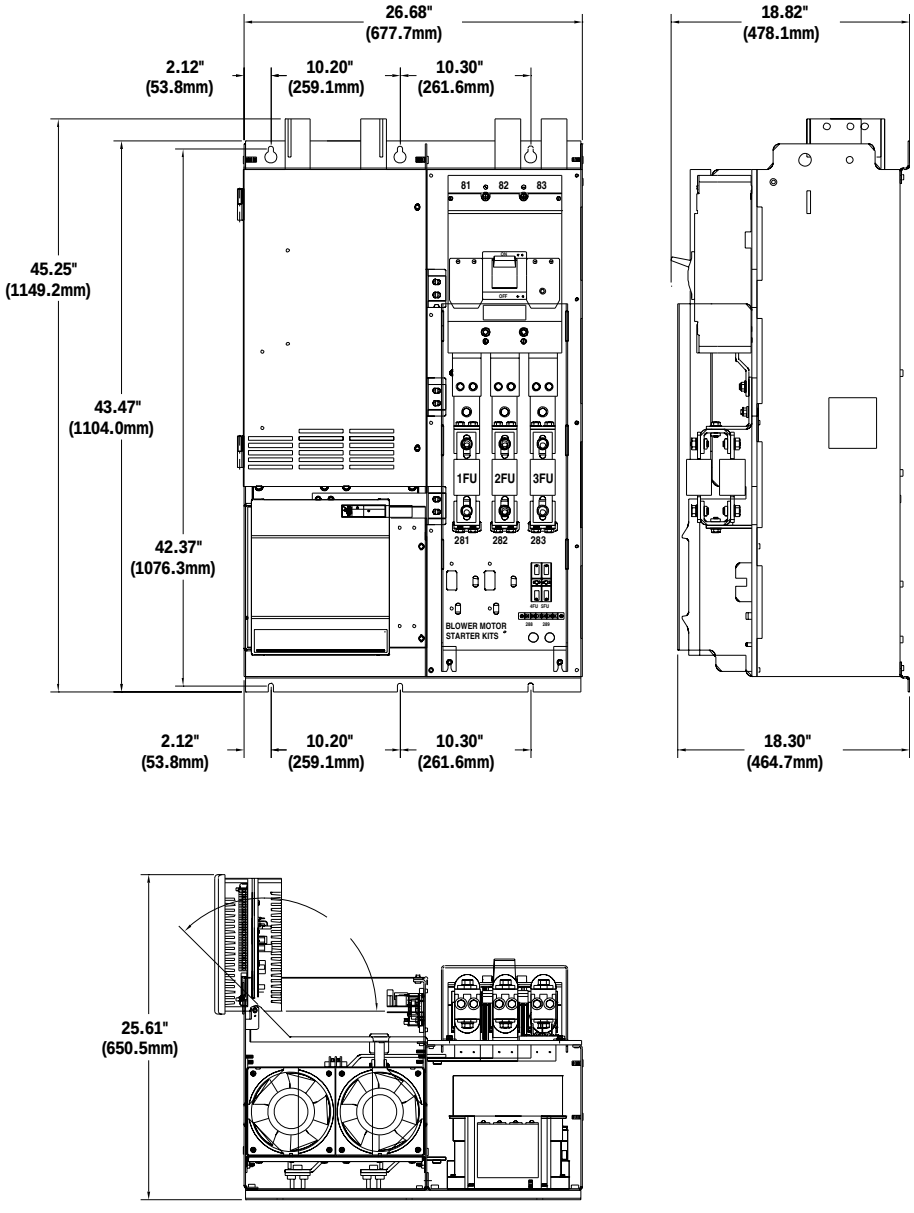


Figure 2.5
Drive Mounting Dimensions –
400 to 600 HP at 460 V AC



Grounding Procedures

The purpose of grounding is to:

- Limit dangerous voltages to ground potential on exposed parts in the event of an electrical fault.
- To facilitate proper operation of overcurrent device when ground fault conditions are incurred.
- To provide suppression of electrical interference.

The general grounding concept for the 1397 is shown in Figure 2.6 and explained below. Specific Drive ground point locations are detailed in Figures 2.7, 2.8 and 2.9.

Safety Ground – Is the safety ground required by code. The ground bus can be connected to adjacent building steel (girder, joist) or a floor ground grid, provided grounding points comply with NEC regulations. Multiple connections are permitted, but Do Not ground at the same point as a Signal Ground. The minimum distance between Signal and Safety Ground is 10 feet (3 meters). The ground bus is limited to a maximum of 1 ohm resistance to ground.

Power Feeder – Each power feeder from the substation transformer to the Drive must be provided with properly sized ground cables. Simply utilizing the conduit or cable armor as a ground is not adequate. The conduit or cable armor and ground wires should be bonded to substation ground at both ends. Each transformer enclosure and/or frame must be bonded to ground at a minimum of two locations.

Motor Connection – Each DC motor frame must be bonded to grounded building steel within 20 feet (6 meters) of its location and tied to the drives Safety Ground via ground wires within the power cables and/or conduit. Bond the conduit or cable armor to ground at both ends. The ground wire size and installation must be per NEC Article 250.

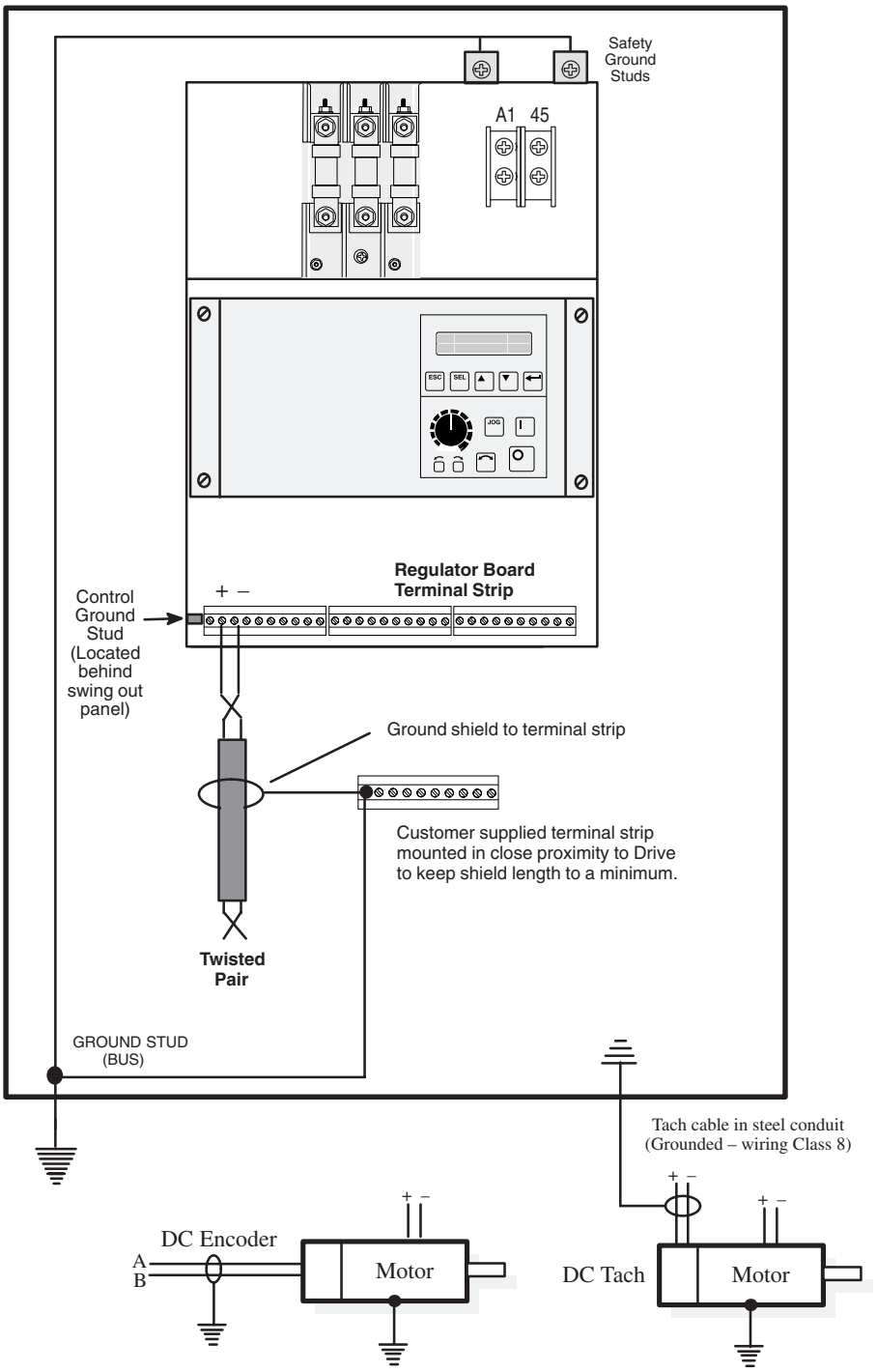
Encoder Connections – If used, must be routed in grounded steel conduit. The conduit must be grounded at both ends. Ground the cable shield at the motor only (See Figure 2.6).

Tachometer Connections – If used, must be routed in grounded steel conduit. The conduit must be grounded at both ends. Ground the cable shield at the Drive end Only (See Figure 2.6).

(CE) Line Filter Connections – For grounding reqirements in CE compliant applications, refer to page B.8 in this manual.

(CE) AC Line Inductor Connections – For grounding reqirements in CE compliant applications, refer to page B.8 in this manual.

Figure 2.6
1397 Grounding Practices



IMPORTANT: For CE requirements refer to Appendix B

Figure 2.7
Drive Ground Point Locations – 1.5-30 HP at 230 V AC
7–100 A @ 380/415 VAC
3-60 HP at 460 V AC

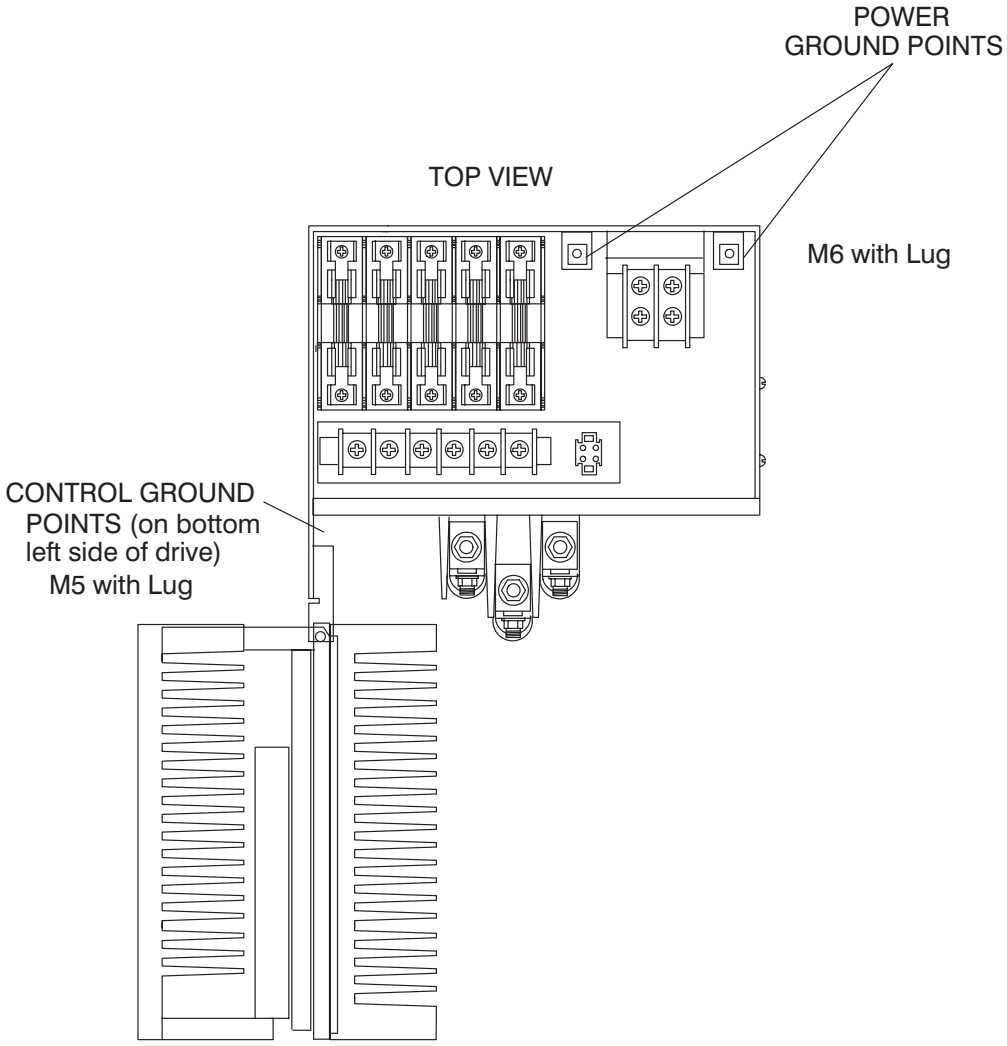
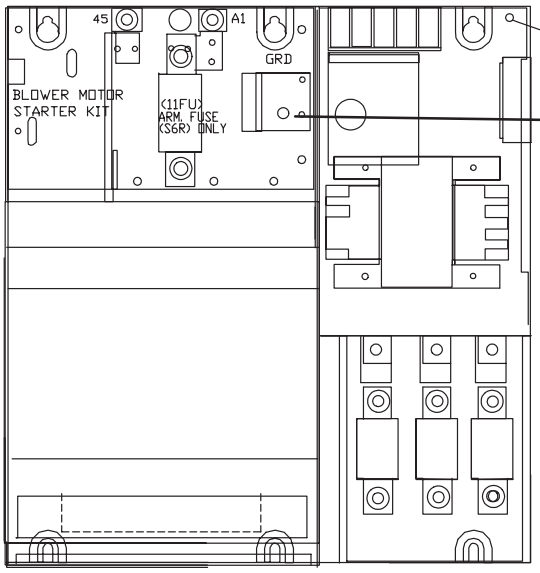
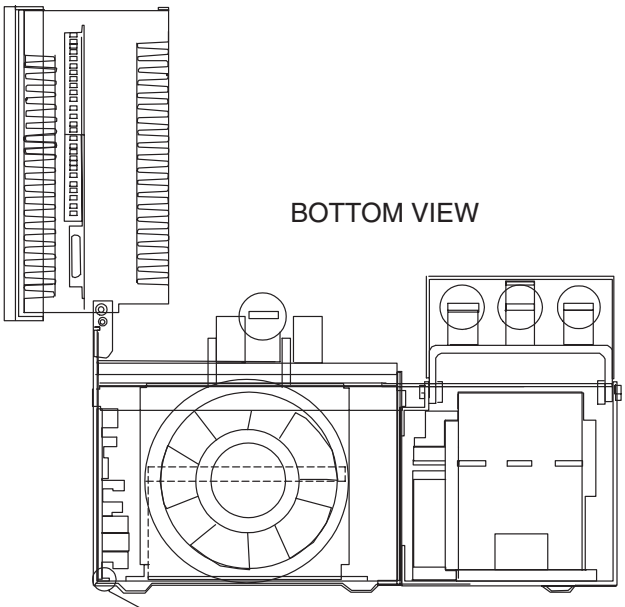


Figure 2.8
Drive Ground Point Locations – 40-75 HP at 230 VAC
265A @ 380/415 VAC
75-150 HP at 460 VAC, 265 Amp Rated Output



FRONT VIEW OF DRIVE
WITHOUT DISCONNECT



BOTTOM VIEW

CONTROL GROUND POINT
M6 With Lug

Figure 2.9
Drive Ground Point Locations – 150 HP at 230 VAC; 300 HP at 460 VAC

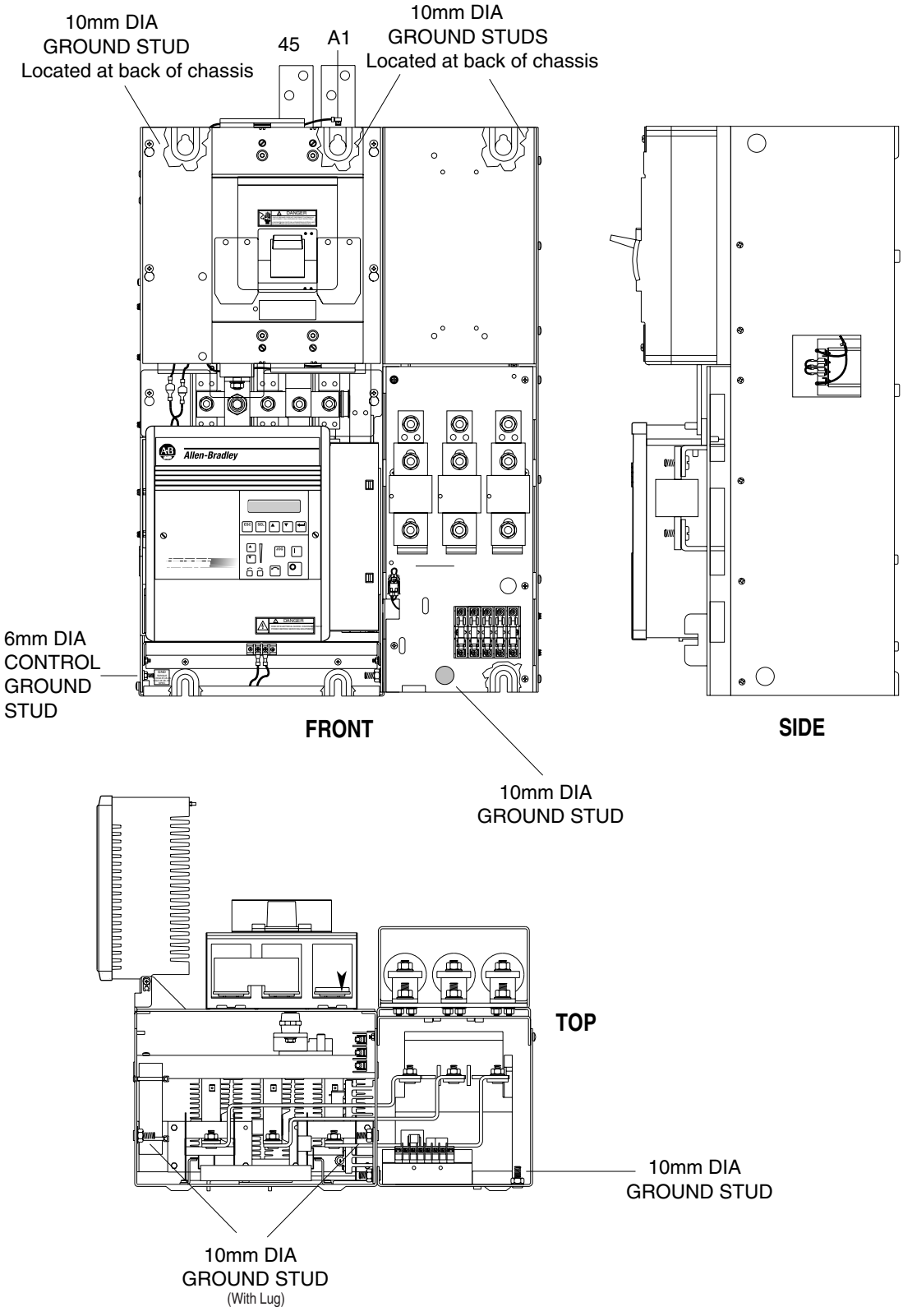


Figure 2.10
Drive Ground Point Locations –
400-600 HP at 460 V AC

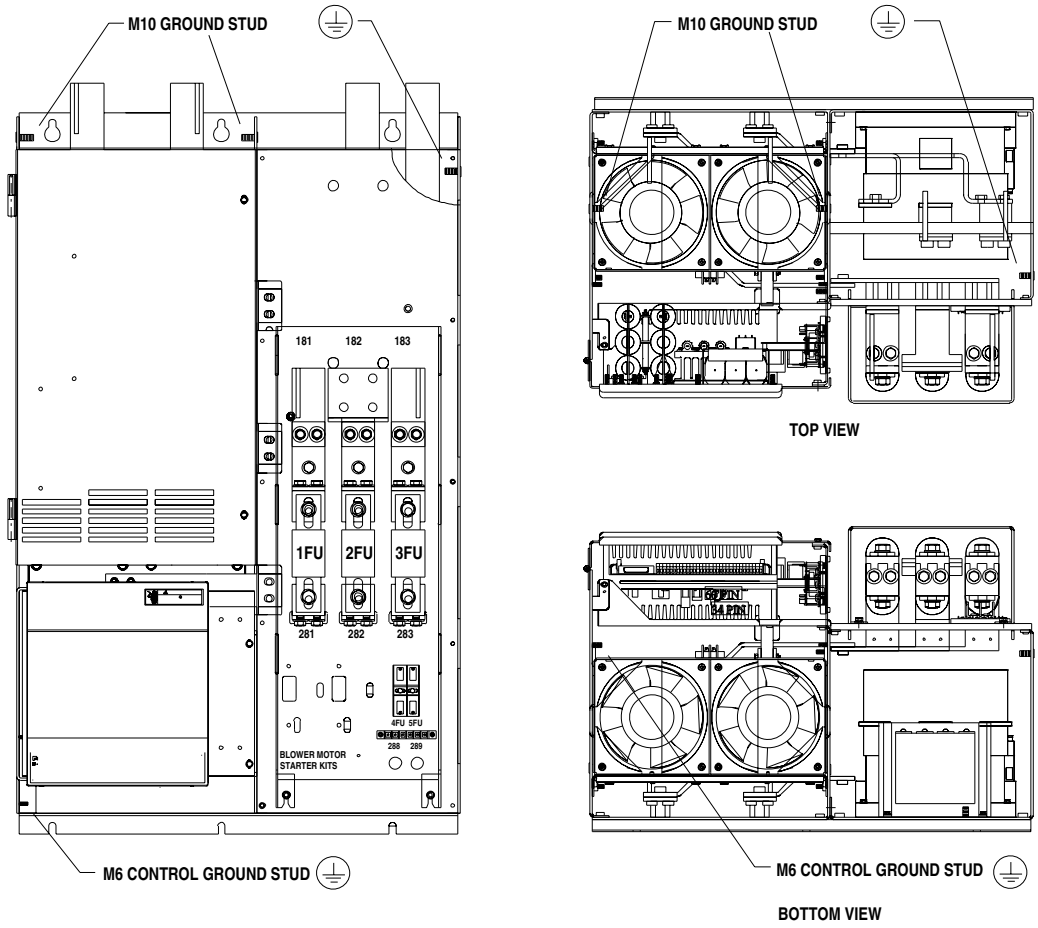


Table 2.A
Chassis Ground Connections

Hardware Size	Tightening
M5	18 lb/in (2Nm)
M6	33 lb/in (3.7 Nm)
M8	100 lb/in (11.3 Nm)
M10	200 lb/in (23 Nm)
Lug with 14–10 AWG	35 lb/in (4 Nm)
Lug with 8 AWG	40 lb/in (4.5 Nm)
Lug with 6–4 AWG	45 lb/in (5.1 Nm)

Wiring Clearance

Although the minimum clearance should be maintained for proper cooling, this space may not always provide proper wiring clearance. The minimum allowable wire bending radius may necessitate that extra space be provided to accommodate power wiring. Consult the governing code for the proper wiring method.

Disconnect

NOTE: You are responsible for completing the installation of the Drive system and to comply with all National and Local Electrical Codes. The following information is to be used as a reference only.

ATTENTION: Hazard of electric shock or equipment damage exist if the Drive is not installed correctly. The National Electrical Code (NEC) and local codes outline provisions for safely installing electrical equipment. Installation must comply with specifications regarding wire types, conductor sizes, branch circuit protection and disconnect devices. Failure to do so may result in personal injury and/or equipment damage.

You must provide a main disconnect and lockout device with cabinet interlocks. This device must be wired in the isolation transformer or reactor primary circuit. The device must be sized to handle 115% of the full load primary current plus any additional loads that are connected to the control system. Proper branch circuit protection for the Drive and additional devices must be provided according to NEC and local codes.

NOTE: Refer to Table on Page 1-6 for Drive current ratings to aid in properly sizing wire.

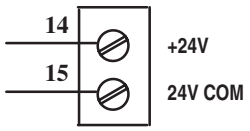
24V Power Supply

The 1397 is equipped with a 250mA 24V power supply to power additional peripheral devices. For example, up to two of the following 24V DC Scanport modules can be used:

1203-GK1 Single Point Remote I/O
1203-GK2 DFI (RS–232 / 422 / 485) or DH–485

If more than two SCANport modules are used with the 1397 Drive, an additional 24V DC power supply must be installed, or 115V SCANport modules must be used. Refer to the SCANport user manual for information on installing additional SCANport modules.

The 24V DC power supply can be accessed at terminals #14 (24V DC) and #15 (24VDC common) of the regulator board terminal strip.



24V DC Power Supply

Wire Size, Type & Class

Wire sizes must be selected individually, observing all applicable safety and NEC regulations. The minimum permissible wire size does not necessarily result in the best operating economy. Due to the Drive overload capacity, the conductors for the transformer primary and secondary must be sized (at a minimum) for 125% of the full load Drive line current. The motor armature conductors must also be rated for 125% (at a minimum) of the full load motor current.

Shielded type wire is recommended in control circuits for protection against interference. A shielded wire is required for all signal wires. The recommended conductor size must be a minimum of 24 AWG. The best interference suppression is obtained with a wire having an individual shield for every pair. Table 2.B provides a listing and description of cable types and wiring recommendations. Figure 2.9 shows recommended cable shielding. Note that wiring classes are for reference only, and are not associated with any code or standard.

Figure 2.11
Cable Shielding Recommendations

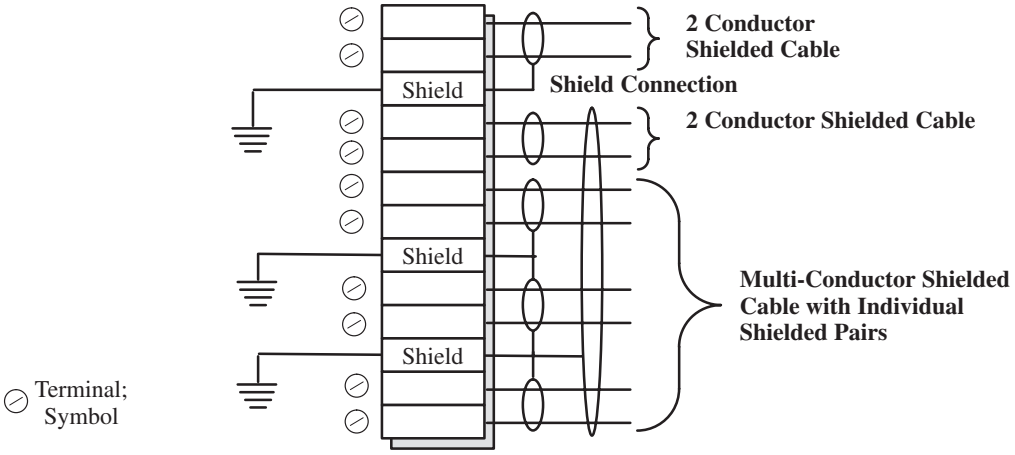


Table 2.B
Cable and Wiring Recommendations

Category	Wiring Class	Signal Definition	Signal Examples	Cable Type	Minimum Spacing in Inches between Classes – Steel Conduit/Tray 1	2/3/4	5/6	7/8	9/10/11	Spacing Notes
Power	1	AC Power (600V or greater)	2.3kV 3/Ph AC Lines	per NEC & Local Codes	0	3/9	3/9	3/18	Note6	1/2/5
	2	AC Power (less than 600V)	460V 3/Ph AC Lines	per NEC & Local Codes	3/9	0	3/6	3/12	Note 6	1/2/5
	3	DC Power	DC Motor Armature	per NEC & Local Codes						
	4	DC Power	DC Motor Field	per NEC & Local Codes						
Control	5	115V AC/DC Logic	Relay Logic/PLC I/O Motor Thermostat	per NEC & Local Codes	3/9	3/6	0	3/9	Note 6	1/2/5
		115V AC Power	Power Supplies, Instruments							
	6	24V AC/DC Logic	PLC I/O	per NEC & Local Codes						
Signal (Process)	7	Analog Signals, DC Supplies	Reference/Feedback Signal, 5 to 24V DC	Shielded Cable – Belden 8735, 8737, 8404	3/18	3/12	3/9	0	1/3	2/3/4/5
		Digital (low speed)	TTL							
	8	Digital (high speed)	I/O, Encoder, Count Pulse Tach	Shielded Cable – Belden 9728, 9730						
Signal (Comm)	9	Serial Communication	RS-232, 422 to Terminals/Printers	Shielded Cable – Belden RS-232 – 8735, 8737 RS-422 – 9729, 9730	Note 6			1/3	0	
	11	Serial Communication (greater than 20k baud)	PLC Remote I/O, PLC Data Highway	Twinaxial Cable – Belden 9463, A-B 1770-CD						

Example: Spacing relationship between 480V AC incoming power leads and 24V DC logic leads.

- 480V AC leads are Class 2 ; 24V DC leads are Class 6
- For separate steel conduits, the conduits must be 3 inches (76 mm) apart
- In a cable tray, the two groups of leads are to be 6 inches (152 mm) apart

LEGEND

2/3/4	Class Spacing
3/9	Steel Conduit/Tray

Spacing Notes:

1. Both outgoing and return current carrying conductors are to be pulled in same conduit or laid adjacent in tray.
2. Cables of the following classes can be grouped together.
   A. Class 1; Equal to or above 601 volts
   B. Classes 2,3, and 4 may have their respective circuits pulled in the same conduit or layered in the same tray.
   C. Classes 5 and 6 may have their respective circuits pulled in the same conduit or layered in the same tray.
   Note: Bundle may not exceed conditions of NEC 310
   D. Classes7 and 8 may have their respective circuits pulled in the same conduit or layered in the same tray.
   Note: Encoder cables run in a bundle may experience some amount of EMI coupling. The circuit application may dictate separate spacing.
   E. Classes 9, 10 and 11 may have their respective circuits pulled in the same conduit or layered in the same tray.
   Communication cables run in a bundle may experience some amount of EMI coupling and corresponding communication faults. The application may dictate separate spacing.
3. All wires of class 7 thru 11 MUST be shielded per the recommendations
4. In cable trays, steel separators are advisable between the class groupings.
5. If conduit is used, it must be continuous and composed of magnetic steel.
6. Spacing of communication cables classes 2 thru 6 is:

CONDUIT SPACING	THRU AIR
115 Volts – 1 inch	115 Volts – 2 inches
230 Volts – 1.5 inches	230 Volts – 4 inches
380/575 Volts – 3 inches	380/575 Volts – 8 inches
575 volts – proportional to 6” per 1000 volts.	575 volts proportional to 12” per 1000 volts

General Notes

1. Steel conduit is recommended for all wiring classes. (Classes 7-11).
2. Spacing shown between classes is the minimum required for parallel runs less than 400 feet. Greater spacing should be used where possible.
3. Shields for shielded cables must be connected at one end only. The other end should be cut back and insulated. Shields for cables from a cabinet to an external device must be connected at cabinet end. Shields for cables from one cabinet to another must be connected at the source end cabinet. Splicing of shielded cables, if absolutely necessary, should be done so that shields remain continuous and insulated from ground.
4. Power wire is selected by load. 16AWG is the minimum recommended size for control wiring.

Motor Installation

The following procedure provides the steps needed to properly install a DC motor for use with a 1397 Drive.

1. Verify that the motor you intend to install is the appropriate rating for use with your model 1397 Drive.
2. Install the DC motor in accordance with the motor manufacturer's installation instructions.
3. Ensure that coupled applications have proper shaft alignment with the driven machine or that belted applications have proper sheave/belt alignment to minimize unnecessary motor loading.
4. If the motor is accessible while it is running, make certain all guards necessary to satisfy local and national codes are installed.
5. Size the motor armature circuit conductors for the specific Drive rating and according to applicable codes.
6. Locate and connect the DC motor armature leads and the shunt field supply leads on the Drive (Figures 2.13 through 2.16).

ATTENTION: 400 to 600 HP @ 460VAC Regenerative Drives require an externally mounted Inverting Fault Protection device connected in the armature circuit. Refer to the instruction manual provided with the Inverting Fault Protection device you have selected for your drive for connection information. Failure to provide Inverting Fault Protection could result in severe bodily injury or loss of life.

Power Wiring Procedure

The following procedure provides the steps needed to properly perform the power wiring connections to the 1397 Drive.

Using Table 2.C, verify that the motor field is compatible with the DC field voltage output of the Drive.

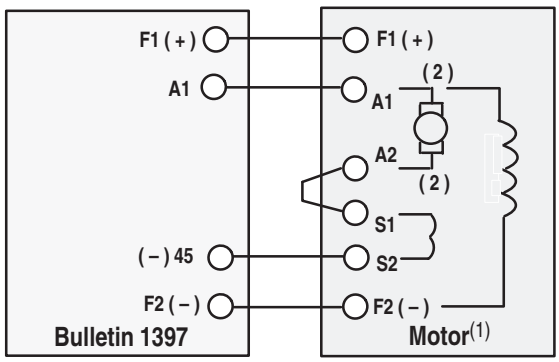
Table 2.C
Standard Field Voltage Output

AC Incoming Voltage to Drive	DC Supply Output Voltage to Field
230V AC	150V DC
380V AC	250V DC
415V AC	270V DC
460V AC	300V DC

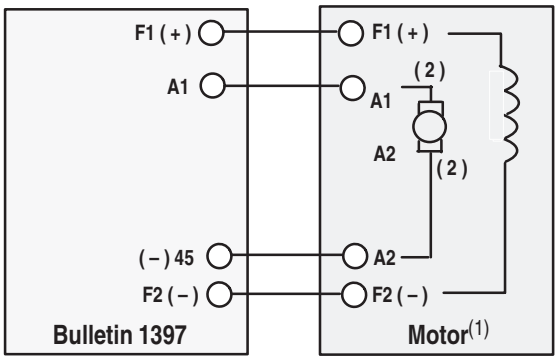
1. Connect the motor armature and field leads to produce proper direction of motor rotation. Figure 2.12 shows the connections required to produce counterclockwise rotation of the motor when viewed from the commutator end with a positive speed reference input to the Drive.

Figure 2.12
Typical DC Motor Connections (CCW) Rotation

1.5 to 150HP @ 230VAC, 3 to 300HP @ 460VAC

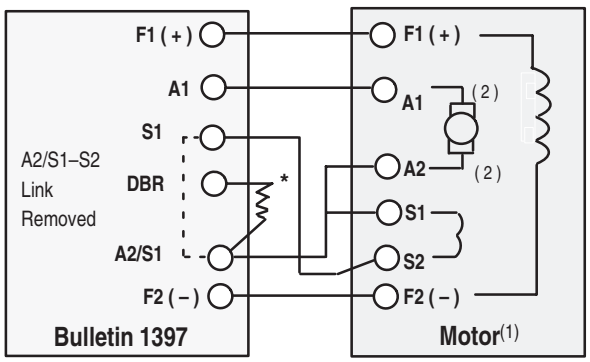


Basic Stabilized Shunt Machine, CCW Rotation, Facing Commutator End



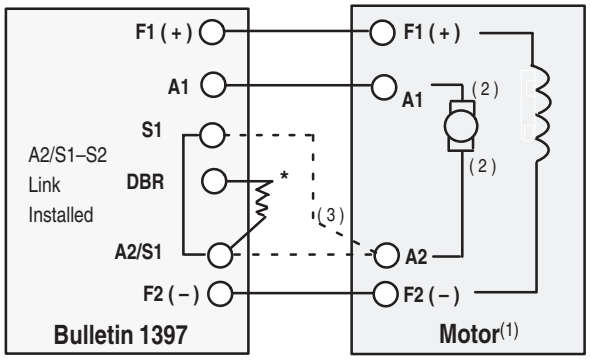
Straight Shunt Machine, CCW Rotation, Facing Commutator End

400 to 600HP @ 460VAC



Basic Stabilized Shunt Machine, CCW Rotation, Facing Commutator End

*If Used



Straight Shunt Machine, CCW Rotation, Facing Commutator End

(1) In cases where full regenerative torque capability is required for braking or slow down operation or where the drive will be applied for bi–directional operation, you should specify straight shunt DC motors (wound without a series field winding) to assure symmetrical motor operation in both forward and reverse directions, full torque capability, and motor stability under any mode of operation.
(2) If this connection of the motor armature leads results in motor rotation opposite of what is required, reverse the A1 and A2 lead connections at the motor.
(3) Connect Drive Terminal A2/S1 or S2 to motor terminal A2.

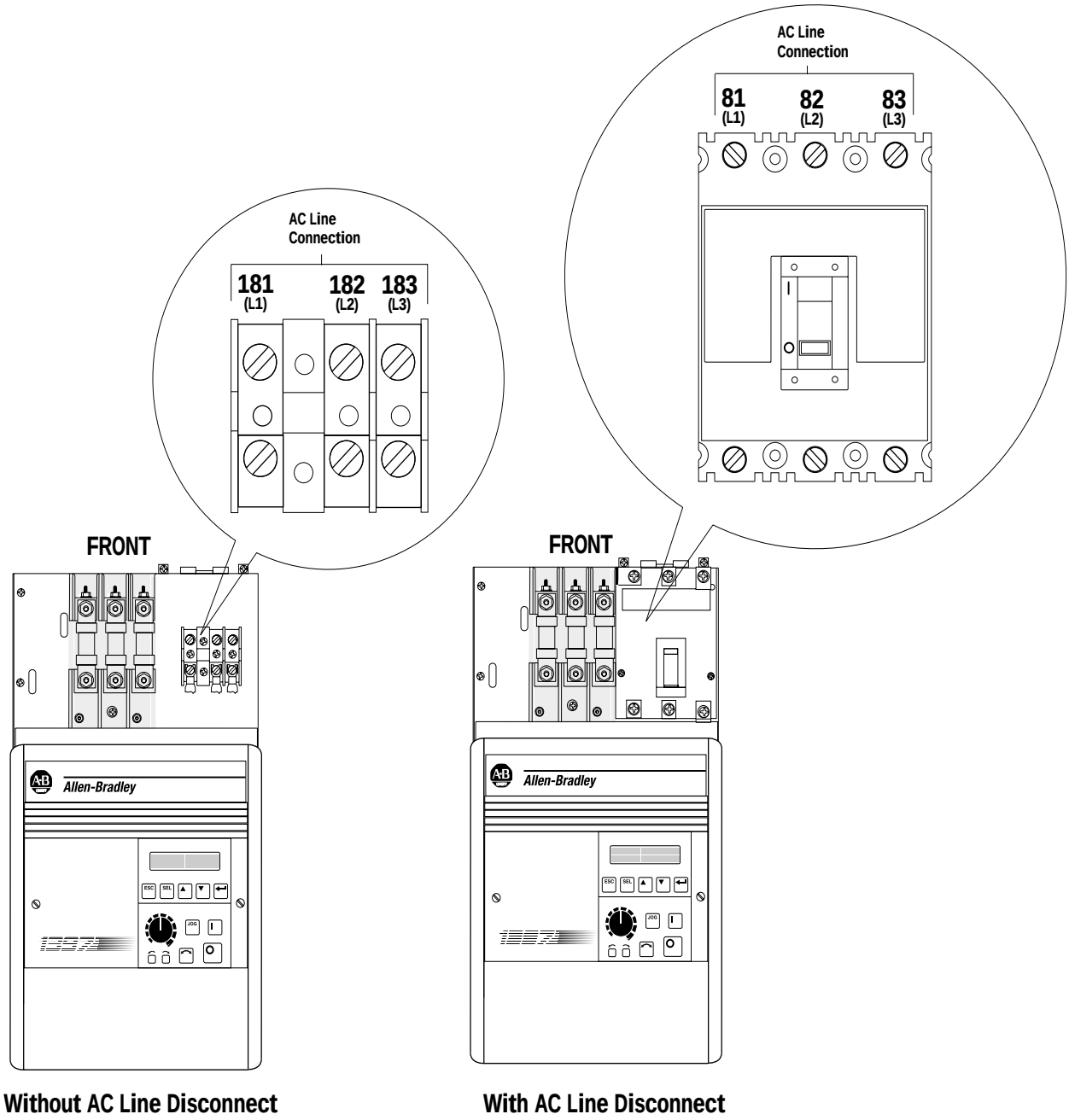
2. The 1397 is supplied with semi conductor fuses for line protection. An isolation transformer can also be used. In general, the 1397 is suitable for direct connection to a correct voltage AC line that has minimum impedance of 3%. If the

line is lower impedance, a line reactor or isolation transformer must be added upline from the Drive to increase line impedance. If the line impedance is too low, transient voltage spikes or interruptions can create excessive current spikes that will cause nuisance input fuse blowing, and may cause damage to the Drive power structure. Refer to Figures 2.13 through 2.16 for AC input wiring at the main fuses and the following ATTENTION note when determining if a line reactor or isolation transformer is required for your installation.

AC Line Connection – Connect incoming three-phase AC line power to the AC Line Terminals as shown in Figures 2.13 through 2.16. Note that the incoming AC power is wired to separate terminals on the 1.5-30HP/3-60HP, 7–110A Drives, but is wired directly to AC line fuses on 40-75HP/75-150HP, 100-150/200-300HP, 265A and higher and 400 to 600 HP Drives. The fuses supplied are designed to provide protection against short circuits for the Drive semiconductors and associated output wiring. They are not to be considered a substitute for the user supplied motor branch circuit protective devices that are required by the National Electrical Code. Refer to Table 2.E for proper sizing of the AC power and branch fuses.

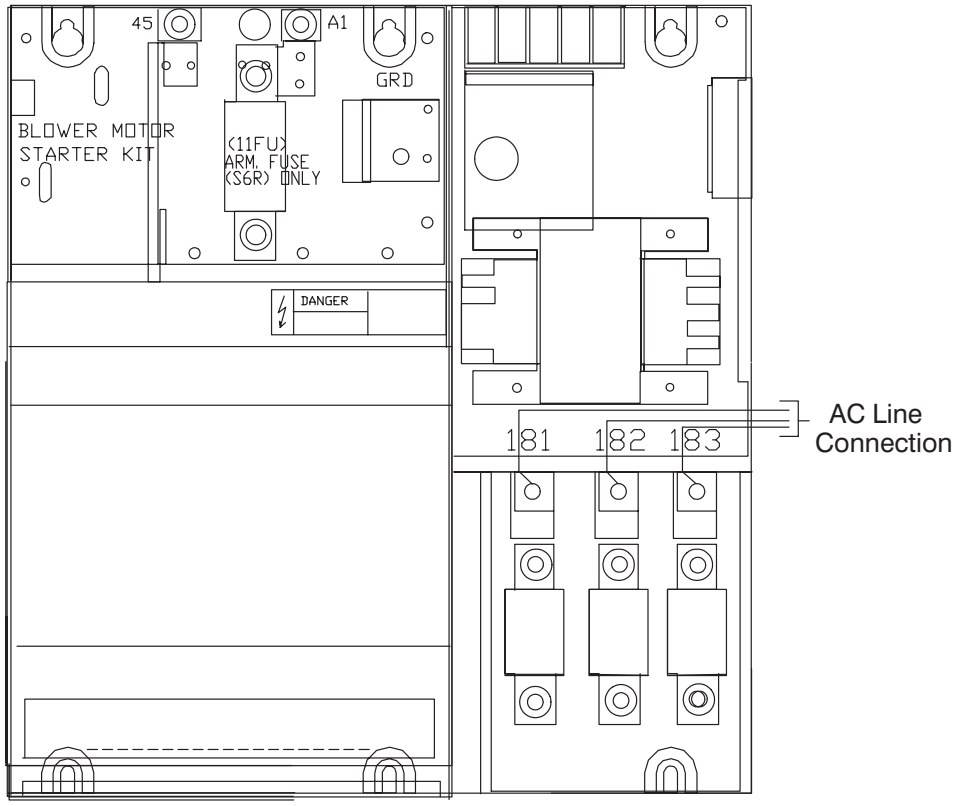
ATTENTION: If the AC input power system does not have a neutral or one phase referenced to ground, an isolation transformer with the neutral of the secondary grounded is **highly recommended**. If the line-to-line voltages on any phase can exceed 125% of the nominal line-to-line voltage, an isolation transformer with the neutral of the secondary grounded, is **always required**. Failure to observe these precautions could result in bodily injury or damage to equipment.

Figure 2.13
AC Line Connection Location
1.5-30 HP at 230 VAC; 3-60 HP at 460 VAC
7-110A @ 380/415 VAC



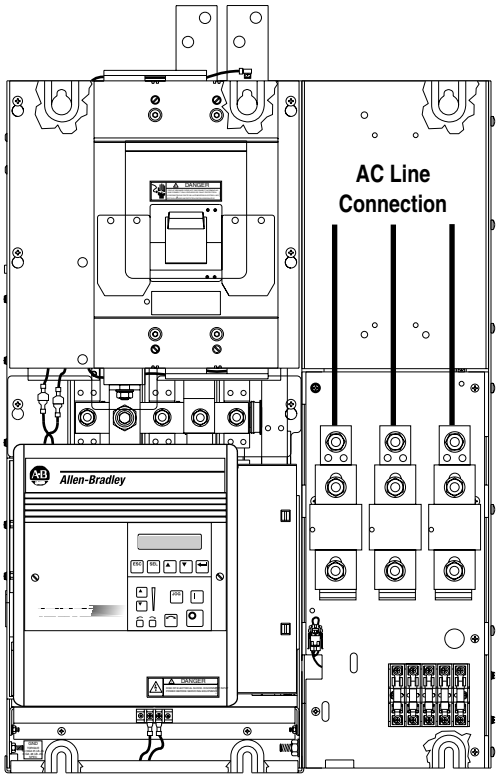
Without AC Line Disconnect **With AC Line Disconnect**

Figure 2.14
AC Line Connection Location
40-75 HP at 230 VAC; 75-150 HP at 460 VAC
265A @ 380/415 VAC



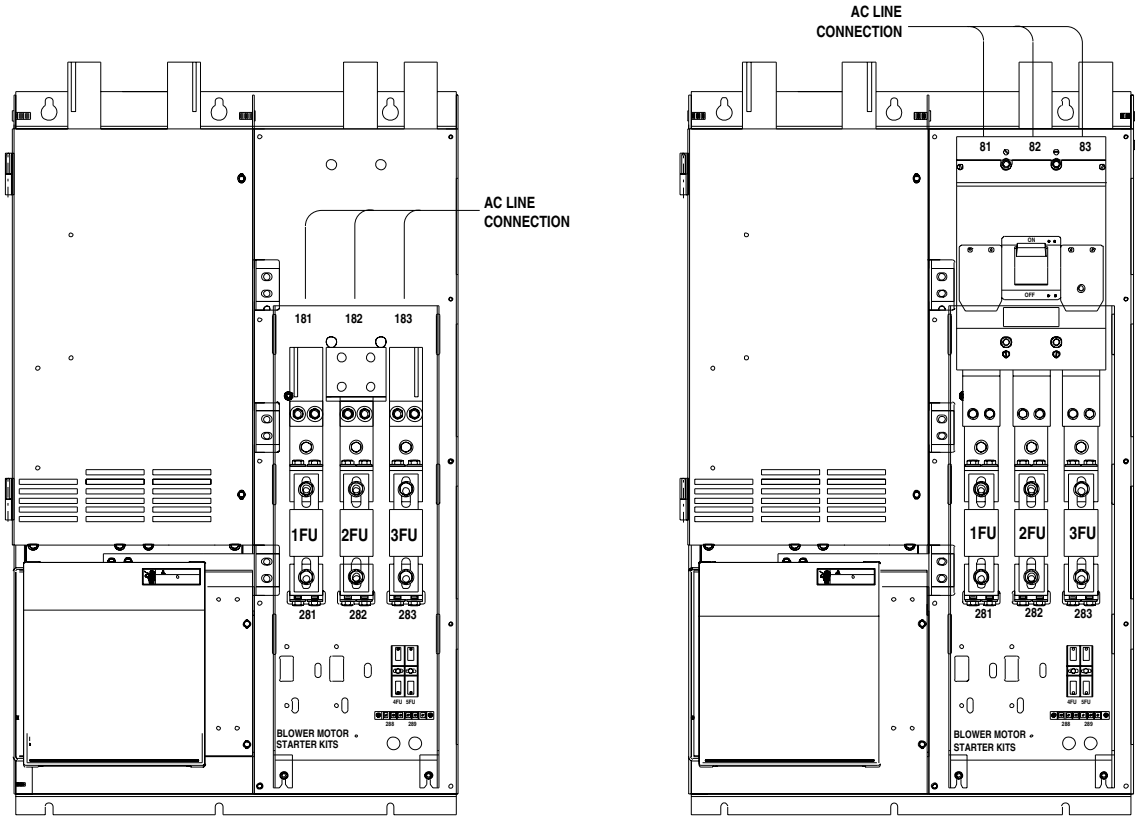
FRONT VIEW OF DRIVE WITHOUT DISCONNECT

Figure 2.15
A-C Line Connection Locations
100-150 HP at 230 V AC; 200-300 HP at 460 V AC



SHOWN WITHOUT
AC LINE
DISCONNECT

Figure 2.16
A-C Line Connection Locations
400-600 HP at 460 V AC



Without AC Line Disconnect

With AC Line Disconnect

Table 2.D
AC Line Connectors

	Recommended Tightening Torque			
HP	**230 V AC**	**380 VAC**	**415 VAC**	**460 V AC**
1.5	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	—
2	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	—
3	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)
5	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)
7.5	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)
10	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)
15	13.6 Nm (120 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)
20	13.6 Nm (120 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)	6.2 Nm (55 lb-in)
25	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)	6.2 Nm (55 lb-in)
30	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)
40	22 Nm (200 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)
50	22 Nm (200 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)	13.6 Nm (120 lb-in)
60	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)	13.6 Nm (120 lb-in)
75	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)
100	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)
125	40 Nm (350 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)
150	40 Nm (350 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)	22 Nm (200 lb-in)
200	—			22 Nm (200 lb-in)
250	—			34 Nm (300 lb-in)
300	—			34 Nm (300 lb-in)
400	—			34 Nm (300 lb-in)
500	—			34 Nm (300 lb-in)
600				34 Nm (300 lb-in)

Note: The tightening torque in the table applies to the wiring device (stud or terminal board) provided. When an input or an output device (breaker or lug kit) is added, refer to the kit instructions for tightening specifications.

Recommended AC Line and DC Armature Fuses

The following tables list the recommended AC line and DC armature fuses for the Drive. The armature fuse is required only for regenerative Drives.

Standard models are shipped with the appropriate fuses.

You must select the correct replacement fuse type from Tables 2.E and 2.F.

Table 2.E
AC Line Fuses

AC Line Fuse (1FU, 2FU, 3FU)						
HP at 230 V AC	HP at 380 V AC	HP at 415 V AC	HP at 460 V AC	Fuse Rating (500 V)	Fuse Class	Manufacturer
1.5-5	2.4	2.8	3-10	40A	**XL50F**	**Bussman**
7.5-10	12	13.8	15-20	80A	**XL50F**	**Bussman**
15	24	27.6	30	90A	**XL50F**	**Bussman**
20-30	48	55.2	40-60	150A	**XL50F**	**Bussman**
40-60	120	138	75-125	300A	**XL50F**	**Bussman**
75			150	350A	**XL50F**	**Bussman**
100			200	600A	**XL50F**	**Bussman**
125-150			250-300	800A	**XL50F**	**Bussman**
			400-600	600A (700V) 2 in parallel	**A70QS600–4K**	**Gould**

Table 2.F
DC Armature Fuses (Regenerative Drives Only)

DC Line Fuse (11FU)					
HP at 230 V AC	A @ 380/415 V AC	HP at 460 V AC	Fuse Rating (700 V)	Fuse Class	Manufacturer
1.5	7	3	15A	**XL70F**	**Bussman**
2	7	4	20A	**XL70F**	**Bussman**
3	7	6	25A	**XL70F**	**Bussman**
5	7	10	35A	**XL70F**	**Bussman**
7.5	29	15	40A	**XL70F**	**Bussman**
10	29	20	50A	**XL70F**	**Bussman**
15	55	30	70A	**XL70F**	**Bussman**
20-25	55	40-50	125A	**XL70F**	**Bussman**
30	110	60	150A	**XL70F**	**Bussman**
40	110	75	200A	**XL70F**	**Bussman**
50	110	100	250A	**XL70F**	**Bussman**
60	110	125	300A	**XL70F**	**Bussman**
75	205	150	350A	**XL70F**	**Bussman**

Figure 2.17
DC Drive Motor Field and Armature Connection Locations
1.5-30 HP at 230 V AC
7-110A @ 380/415 VAC
3-60 HP at 460 V AC

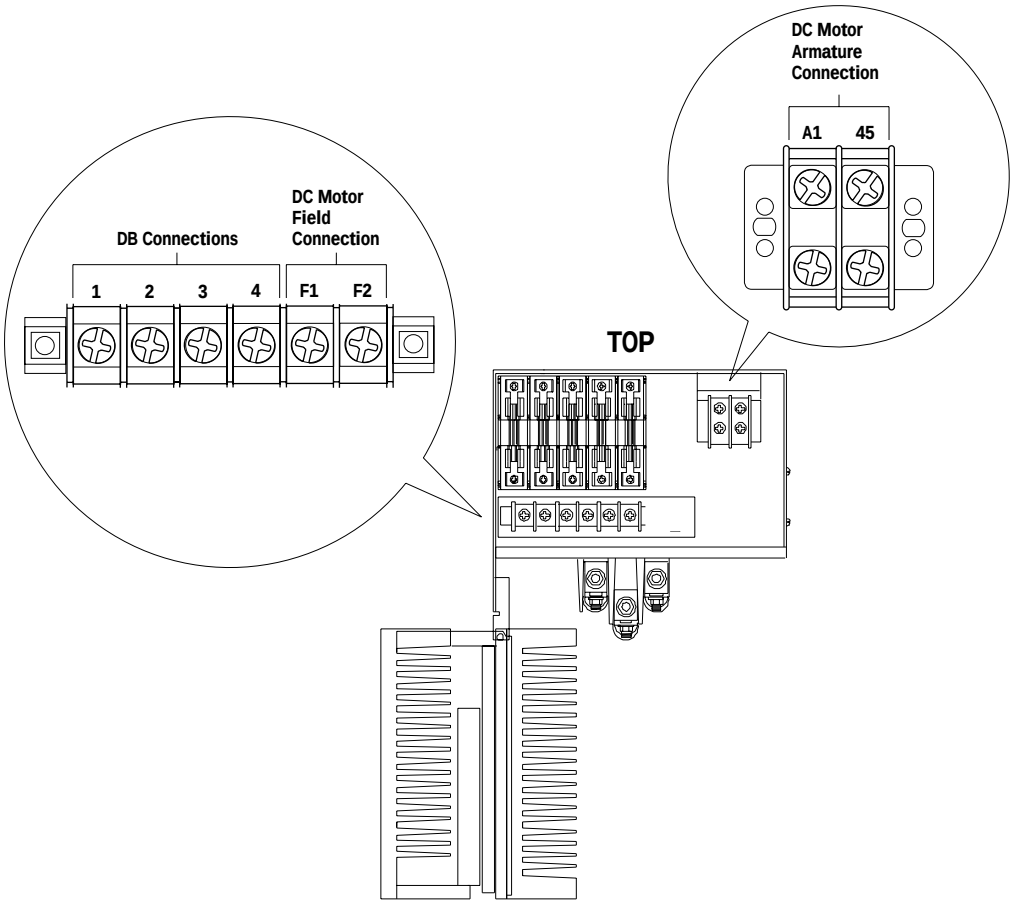
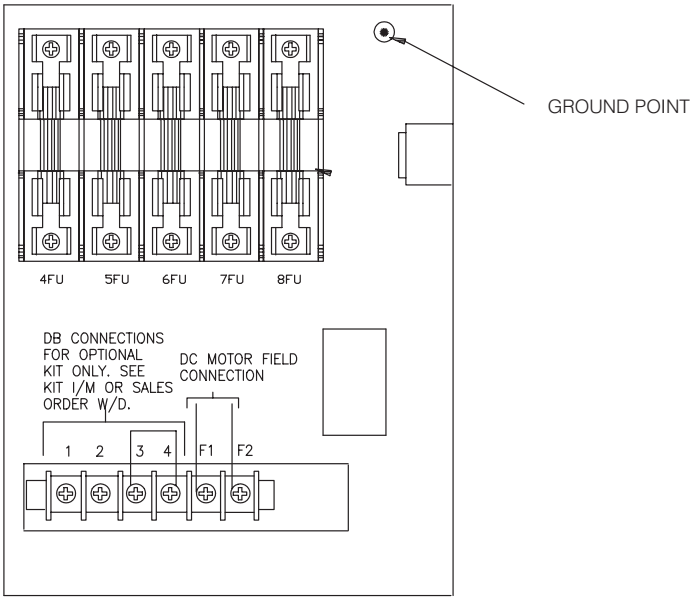
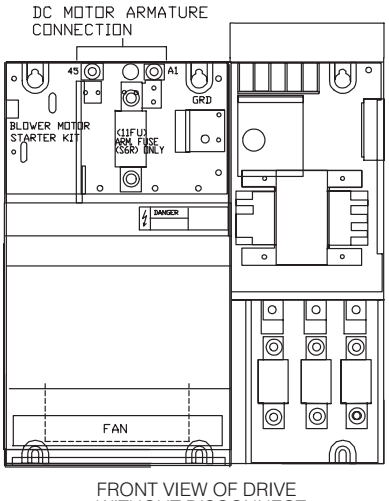


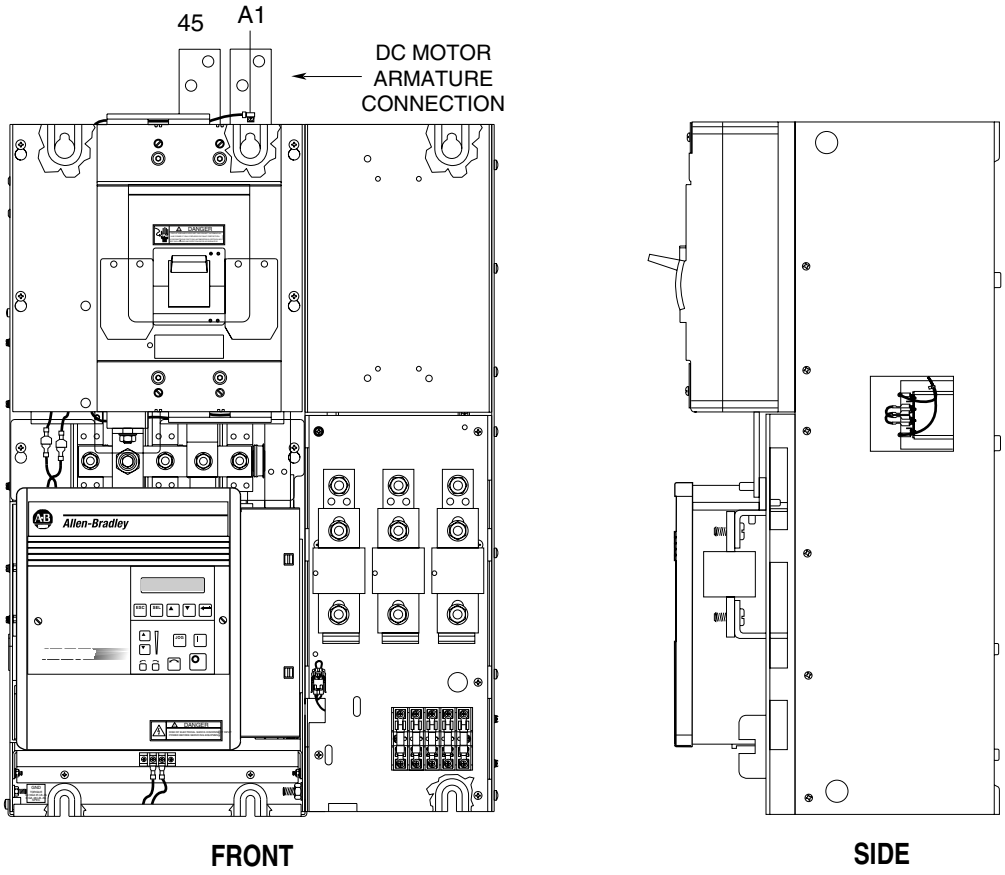
Figure 2.18
DC Motor Field and Armature Connection Locations
40-75 HP at 230 VAC
265A @ 380/415 VAC
75-150 HP at 460 VAC





FRONT VIEW OF DRIVE
WITHOUT DISCONNECT

Figure 2.19
DC Motor Field and Armature Connection Locations
100-150 HP at 230 V AC,
200-300 HP at 460 V AC



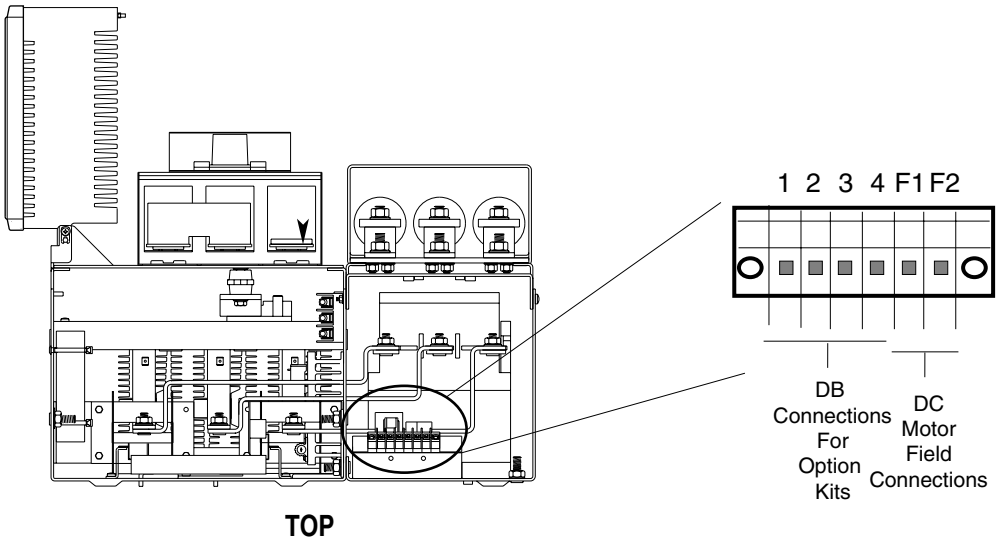
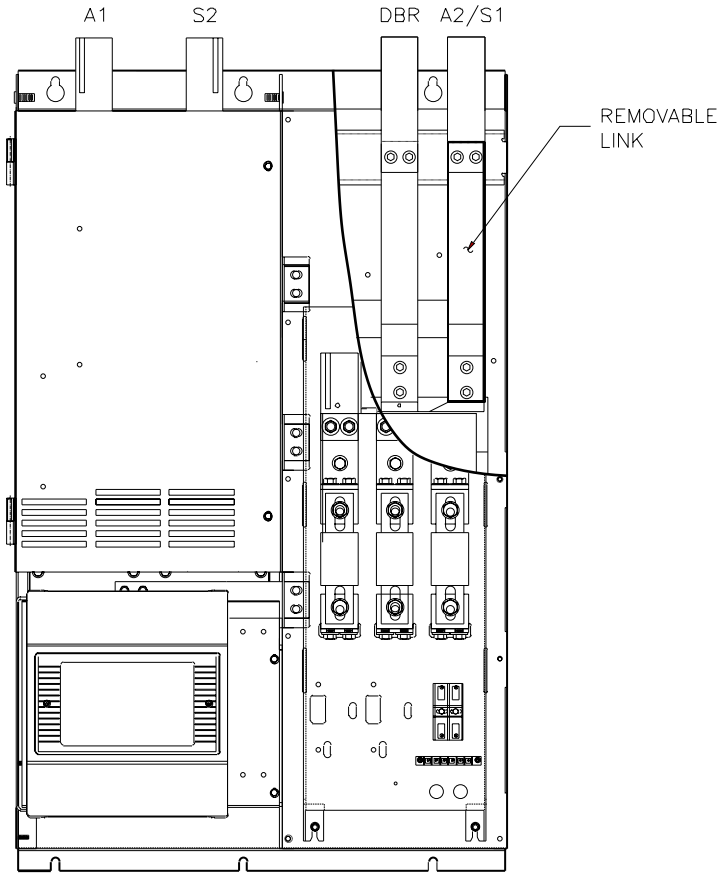


Figure 2.20
DC Motor Field and Armature Connection Locations
400-600 HP at 460 V AC



Control Connections

The Bulletin 1397 is supplied with the following standard I/O compliment:

- **10 Digital Inputs**
  24V DC internally or externally supplied
  8V DC turn–on voltage
  0.5 mA turn–off current
- **3 Contact Outputs**
  250V AC maximum
  30V DC maximum
  2A maximum resistive load
  1A maximum inductive load
- **2 Speed Reference Inputs**
  Analog Reference 1
  ±10V DC
  4 – 20 mA
  10 – 50 mA
  Converted within Drive to 12 bit plus sign

  Analog Reference 2
  External potentiometer (5kΩ min.)
  ±10V DC
  Converted within Drive to 12 bit plus sign
- **DC Tachometer Input**
  10 – 250V DC
  Converted within Drive to 12 bit plus sign
- **2 Analog Outputs**
  ±10V DC
  4A maximum load

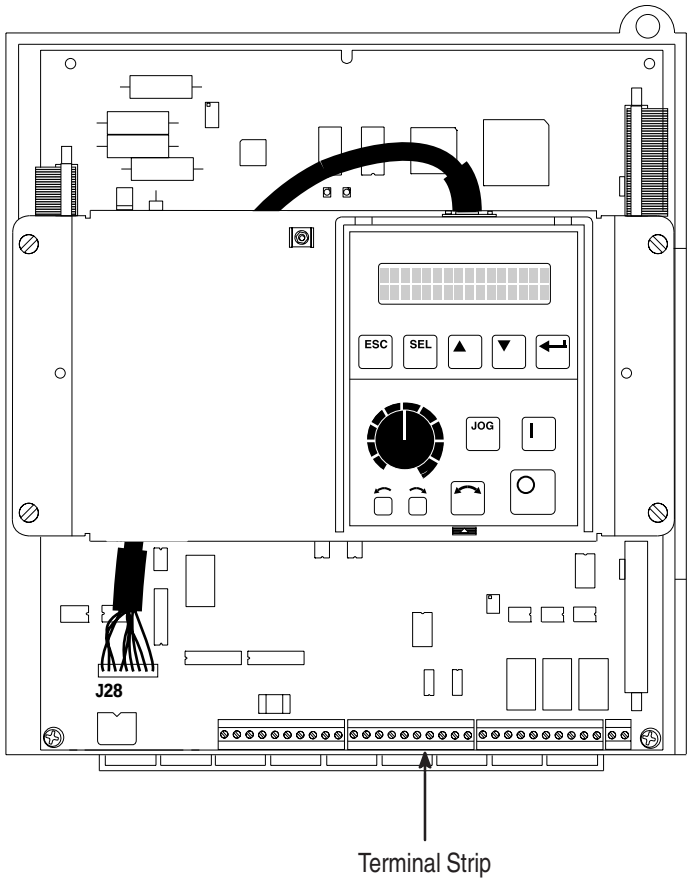
In order to maintain simplicity, the functions of the analog and digital inputs are fixed. The analog and digital outputs, however, may be reconfigured. See Chapter 5 for information on parameters that must be manipulated to reconfigure the outputs.

ATTENTION: The 1397 Drive control circuitry includes solid–state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required to remove AC line power to the Drive. When AC input power is removed, there will be a loss of inherent regenerative braking effect and the motor will coast to a stop. An auxiliary braking method may be required.

Control Wiring Procedure

Most control connections on the 1397 Drive are made at the Regulator Board Terminal Strip which is located at the bottom of the Drive as shown in Figure 2.21.

Figure 2.21
Regulator Board Terminal Strip Location



Regulator Board Input Signal Definitions

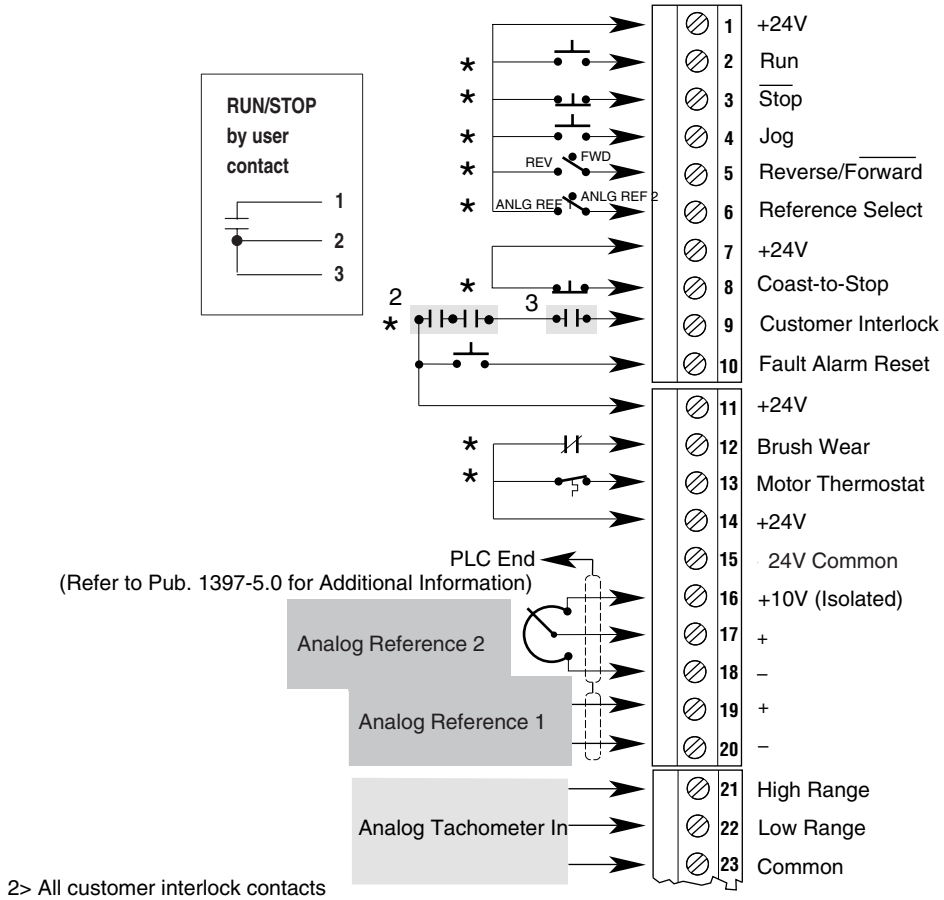
The 1397 Drive will recognize a change in the state of a digital input (e.g. 0-24VDC) if it is applied longer than 20 ms. Power (24VDC) signals are available on regulator terminal block pins TB-01, TB-07, TB-11 and TB-14. The associated common connection is present on TB-15. The Digital inputs shown Figure 2.18 are defined as follows:

TB–01 POWER – A 24VDC supply is available at this pin.

TB–02 RUN – Edge sensitive signal that initiates a Run command (0 ➾ 1 = Run). If the Drive is Run, voltage may be applied to the armature causing the motor to reach the desired speed. The Run input is latched and therefore does not have to be maintained to keep the drive *Running*. This input can be masked through the [**Run Mask**] (P. 201) or [**Logic Mask**] (P.207) parameters.

TB–03 STOP – This is a level sensitive signal that initiates a Stop command (0 = Stop, 1 = Not Stop). The stopping mode is determined by the [**Stop Mode Type**] (P. 115) parameter. This input CANNOT be masked. Both the customer interlock And Coast to Stop must be made for the Drive to be READY.

Figure 2.22
Terminal Strip Inputs

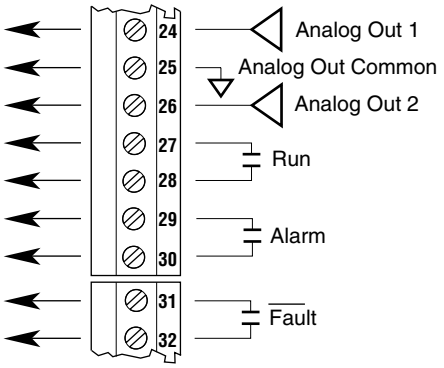


Regulator Board Terminal Strip Inputs

2> All customer interlock contacts must be closed for drive operation.

3> The circuit breaker is supplied with 200-300 HP regenerative drives. Note that if any other interlocks are required for your application, they must be connected in series with the circuit breaker contact to the customer interlock input.

* = Required for initial startup and operational checks. Voltage must be present at these points during operation.



Regulator Board Terminal Strip Software Configurable Output Connections
(Drive Contacts Shown In Unpowered State)

TB–04 JOG – This is a edge sensitive signal that initiates a Jog command (0 ➾ 1 = Jog, 0 = Not Jog). If the Drive is *READY* and not already *RUNNING,* voltage will be applied causing the motor to reach the value of Jog Reference. The Drive will Jog for only as long as this input is asserted. This input can be masked through the [**Jog Mask**] (P. 203) or [Logic Mask] (P. 207) parameter. When released, the Drive will ramp to zero speed based on the [**Jog/Acc/Dec Time**] (P. 092). The contactor will open based on [**Jog Off Dly Time**] (P. 094).

TB–05 REVERSE/FORWARD – This is a Level sensitive signal that selects the commanded direction, *Forward* = 0 or *Reverse* = 1. This input can be masked through the [**Direction Mask**] (P. 202) or [**Logic Mask**] (P 207) parameter. If it is not masked, it will assume control of the drive reference.

TB–06 REFERENCE SELECT – This is a edge sensitive signal that selects between REF 1 Source (= 1) and REF2 Source (= 0) parameters to be used as a reference to the Drive. The input can be masked through the [**Reference Mask**] (P 204) or [**Logic Mask**] (P 207) parameters. If it is not masked, it will assume control of the Drive reference. If an I/O Expansion board is installed, the Preset Speed selection bits will override the reference selected by this input.

TB–07 POWER – A 24VDC supply is available at this pin.

TB–08 COAST-TO-STOP – Level sensitive input that causes a Coast Stop command (Open = Stop, Closed = NOT Stop). The contactor is forced to open by hardware intervention (i.e. hardware only), making the motor coast to rest (if *Running*). This input is not maskable and is always active. When the Coast-to-Stop input is open, the Drive will be *Not Ready.* If an optional Dynamic Braking (DB) kit is present, the braking resistor is automatically applied when the contactor breaks the armature circuit.

TB–09 CUSTOMER INTERLOCK – Level sensitive input that causes a Coast Stop command (0 = Stop, 1 = NOT Stop). The contactor is forced to open through firmware, making the motor coast to rest (if Running). The input allows external user interlock signals to be part of the Drive ready logic. This input CANNOT be masked.

TB–10 FAULT/ALARM Clear – Edge sensitive input that clears fault and/or alarm indicator(s) (0 ➾ 1 = Clear). The fault and alarm log entries are not affected. This input can be masked through the [**Fault Reset Mask**] (P 205) or [**Logic Mask**] (P 207) parameters.

TB–11 POWER – A 24VDC supply is available at this pin.

TB–12 MOTOR BRUSH WEAR – Level sensitive input that causes a motor brush wear alarm (0 = ALARM). The Drive can still operate under this condition. This input CANNOT be masked.

TB–13 MOTOR THERMOSTAT – Level sensitive input that causes a motor thermostat fault (0 = FAULT). The Drive will be faulted while this input is true. This input CANNOT be masked.

TB–14 POWER – A 24VDC supply is available at this pin.

TB–15 COMMON – A 24VDC common supply is available at this pin.

TB–16,17,18 ANALOG REFERENCE 2 – Fixed ± 10VDC analog reference.

TB–19,20 ANALOG REFERENCE 1 – Signal type selected by Anlg In 1 Type (P.128) parameter (0–10 VDC, ±10 VDC, 4-20mA, 10–50mA) and hardware jumpers on the regulator board (J10 and J12).

TB–21,22,23 ANALOG TACHOMETER IN – Use of #21 or #22 is determined by J14 hardware jumper on the regulator.

ATTENTION: If motor rotation is changed by reversing either the motor armature lead connections or the field connections, the Pulse Encoder feedback polarity on the B and NOT B leads must be reversed. If a DC Tach is used, feedback polarity must also be reversed. Failure to observe this precaution could result in personal injury or damage to equipment.

1. Wiring the Coast Stop Circuit

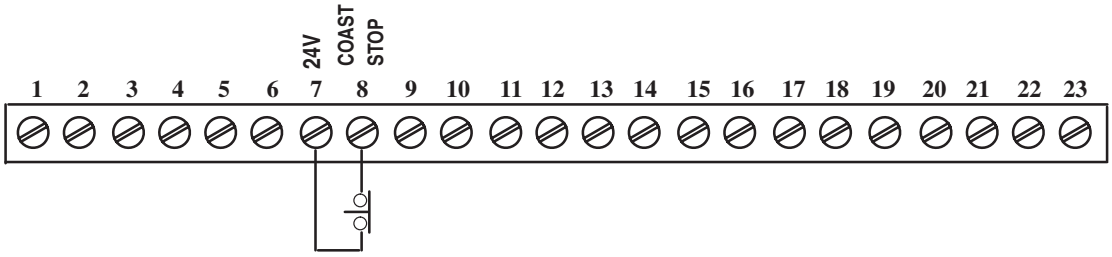
The 1397 Drive has the capability to accept an input from either a 24VDC or 115VAC contact (If the 115 VAC Control Option Board is installed). The contact must be normally closed and will typically be a Stop pushbutton. Refer to the following paragraphs for connection information. This input cannot be masked and is always active.

ATTENTION: The Run/Stop and customer interlock circuitry in this Drive is composed of solid-state components. A hardwired Coast to Stop circuit must be used with this Drive. For 115VAC control, this circuitry may be added on the optional 115VAC Control Board.

ATTENTION: If Dynamic Braking is used as an alternative stopping method, DO NOT use a hardwired Stop device that removes AC line power. This will de-energize the shunt field, causing a loss of the DB effect and the motor will coast to a stop. Hazards to personnel may exist if the machine is allowed to coast to a stop.

24V DC INPUT – If 24VDC COAST TO STOP is desired, the contacts of the ECOAST device must be wired to terminals 7 and 8 of the regulator board terminal strip as shown in Figure 2.23.

Figure 2.23
Regulator Board Terminal Strip 24VDC Inputs



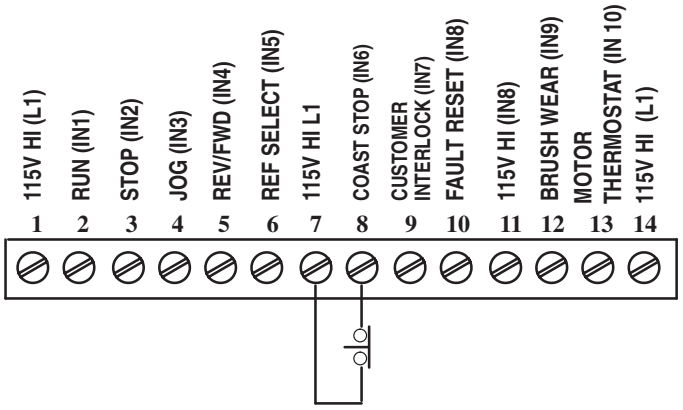
ATTENTION: Applying improper input voltage could damage the regulator board. Make certain that only 24VDC is being applied to the Regulator board terminal strip. If 115VAC inputs are desired, an optional 115VAC Control Option Board is required!

115V AC INPUT – If you are using 115VAC inputs for control, a 115 VAC Control Option Board must be installed and wired to your regulator board. If the 115VAC Control Board is not installed on your 1397, follow the instructions provided with the 115V Control Board option kit to install the board before proceeding with control wiring.

ATTENTION: The Drive and 115 VAC Control Option Board are at Line Voltages when connected to sources of incoming AC power. Disconnect, Tag and Lockout all sources of AC power to the Drive and the 115VAC Option Board before performing the following procedure. Failure to observe these precautions could result in personal injury or loss of life.

115V AC COAST TO STOP inputs are installed at terminals 7 and 8 of the CON2 connector on the 115VAC option board as shown in Figure 2.24.

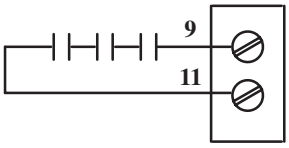
Figure 2.24
CON 2 Terminal Strip 115 VAC Inputs



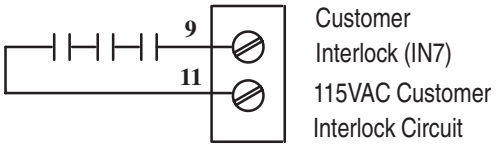
2. Wiring Customer Interlocks

Wire the Customer Interlock as shown in Figure 2.25. Both the 24V Regulator Board Terminal Strip and the 115VAC CON2 Terminal Strip utilize terminal #9 and #11 as the connection point for a Customer Interlock. All customer interlocks must be closed for Drive operation and CANNOT be masked.

Figure 2.25
Wiring Customer Interlocks



Regulator Board Terminal Strip
24VDC Customer Interlock Circuit



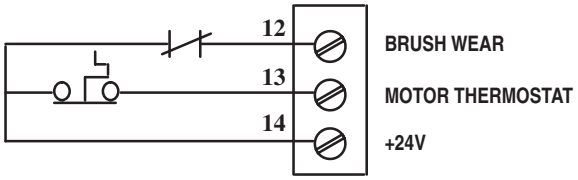
115VAC Option Board CON 2
115VAC Customer Interlock Circuit

3. Wiring the Motor Thermostat/Brush Wear Circuits

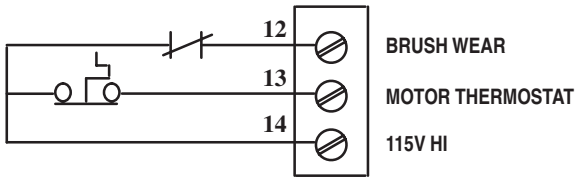
Either a 24VDC or 115VAC input can be used to receive an external voltage for a normally closed contact used in a motor thermostat circuit. As shown in Figure 2.26, Terminal 13 is used for the motor thermostat circuit on both 24VDC and 115VAC configurations. If the motor thermostat circuit is open, the Drive will display a fault and coast to a stop.

Terminal 12 is used for a level sensitive input that triggers a motor brush wear alarm. The Drive will continue to operate under this condition. Both the MOTOR BRUSH WEAR and MOTOR THERMOSTAT inputs are always active and CANNOT be masked.

Figure 2.26
Motor Thermostat/Brush Wear Wiring



Regulator Board Terminal Strip
24VDC Thermostat/Brush Wear Circuit



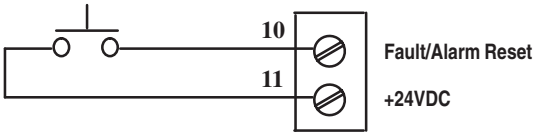
115VAC Option Board CON 2
115VAC Thermostat/Brush Wear Circuit

The contacts of the motor thermostat and Brush Wear must be N.C. The Drive interprets a voltage at Terminals 12 & 13 as a normal expected condition. This input CANNOT be masked.

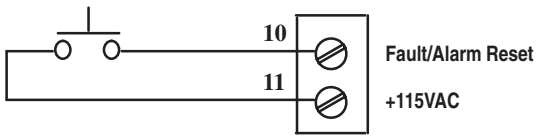
4. Wiring the Fault/Alarm Reset Circuit

This input clears fault and/or alarm indicators and resets the circuit. As shown in Figure 2.27 the Fault/Alarm Reset circuit requires a N.O. operator device that closes to cause a reset. This input can be masked using the [**Fault Reset Mask**] (P. 205) or [**Logic Mask**] (P. 207).

Figure 2.27
Fault/Alarm Wiring



Regulator Board Terminal Strip
24VDC Fault/Alarm Reset Circuit

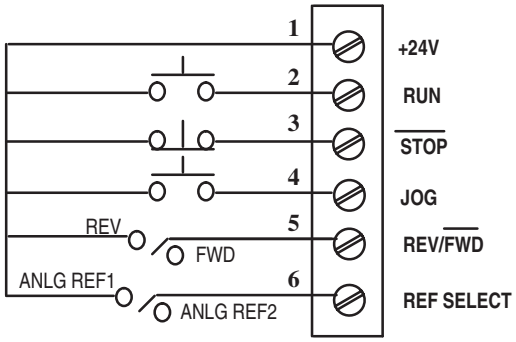


115VAC Option Board CON 2
115VAC Fault/Alarm Reset Circuit

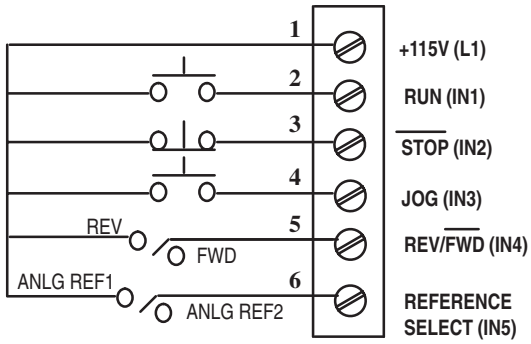
5. Wiring the Control I/O Circuits

Both the 24VDC and 115VAC control circuits use the # 1 thru #6 terminals on their respective terminal strips for control functions as shown in Figure 2.28.

Figure 2.28
Control I/O Wiring



Regulator Board Terminal Strip
24VDC Control I/O Connections



115VAC Option Board CON 2
115VAC Control I/O Connections

The RUN connection is made at terminal 2 on both 24VDC and 115VAC terminal strips. The Run input is latched and therefore does not have to be maintained to keep the Drive *Running*. This input can be masked through the [**Run Mask**] (P. 201) or [**Logic Mask**] (P. 207) parameter.

The STOP connection is made at terminal 3 on both 24VDC and 115VAC terminal strips. The stopping mode is determined by the [**Stop Mode Type**] (P. 115). This input CANNOT BE MASKED.

ATTENTION: If Dynamic Braking is used as an alternative stopping method, DO NOT use a hardwired Stop device that removes AC line power. This will de-energize the shunt field, causing a loss of the DB effect and the motor will coast to a stop. Hazards to personnel may exist if the machine is allowed to coast to a stop.

ATTENTION: You have the ultimate responsibility to determine which stopping method is best suited to the application and will meet applicable standards for operator safety.

The JOG connection is made at terminal 4 on both 24VDC and 115VAC terminal strips. The Drive will jog when this input is asserted, if the Drive is *Ready* and not already *Running*. This input can be masked through the [**Jog Mask**] (P. 203) or [**Logic Mask**] (P. 207).

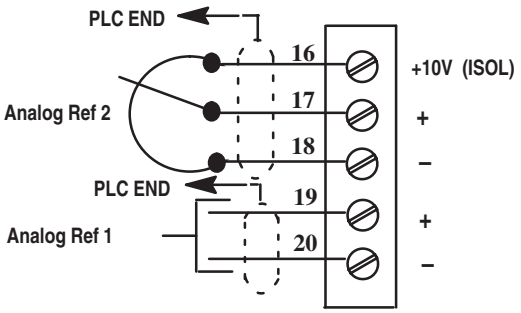
The DIRECTION connection is made at terminal 5 on both 24VDC and 115VAC terminal strips. This level sensitive input selects between *Forward* (= 0) and *Reverse* (= 1). This parameter can be masked through the [**Direction Mask**] (P. 202) or [**Logic Mask**] (P. 207) parameters.

The REFERENCE SELECT connection is made at terminal 6 on both 24VDC and 115VAC terminal strips. This level sensitive input selects between *ANALOG REFERENCE 1* (= 1) and *ANALOG REFERENCE 2* (= 0) parameters to be used as the reference to the Drive. This parameter can be masked through the [**Reference Mask**] (P.204) or [**Logic Mask**] (P. 207) parameters. NOTE: If an I/O expansion board is installed, the Preset Speed selection bits will override the reference selected by this input.

6. Wiring the Analog Input Circuits

Terminals TB16 thru TB23, as shown in Figure 2.29 are used for reference and feedback signals.
ANALOG REFERENCE 2 is a fixed ± 10 VDC reference which is connected at terminals 16, 17 and 18.
ANALOG REFERENCE 1 which is connected at Terminals TB19 and TB20 is a selectable signal type reference determined by [**Anlg In 1 Type**] (P. 128) and regulator board jumpers J10 and J12.
ANALOG REFERENCE 1 can be set for 0-10 VDC, ±10 VDC, 4-20mA or 10-50 mA.

Figure 2.29
Regulator Board Terminal Strip
Analog Input Connections

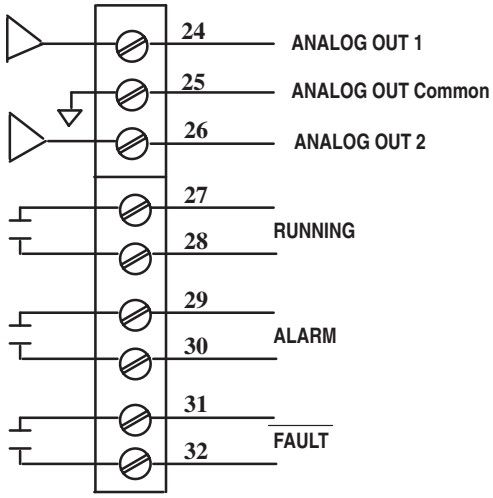


7. Wiring the Output Circuits

The 1397 Drive contains 2 Analog Outputs and 3 Digital Outputs as illustrated in Figure 2.30.
The Analog Outputs are fixed +/– 10 VDC outputs that are updated every 20 ms by the Drive and are sent thru a 100 ms running averaging filter within the drive.
ANALOG OUTPUT 1 is connected at terminals 24 and 25 and [**Anlg Out 1 Src**] (P 145) determines which Drive testpoint is the source selected.
ANALOG OUTPUT 2 is connected at terminals 25 and 26 and [**Analog Out 2 Src**] (P. 148) determines which Drive testpoint is the source selected.

The Digital Outputs indicate the present operating state of the Drive and are connected as follows:
Terminals 27–28 – 1 = Running 0 = Not Running
Terminals 29–30 – 1 = Alarm active 0 = No alarms active
Terminals 31–32 – 0 = Fault active 1 = No faults active

Figure 2.30
Regulator Board Terminal Strip Output Connections



Programming Terminal

General

Chapter 3 describes the various controls and indicators found on the optional Human Interface Module (HIM). The material presented in this chapter must be understood to perform the start-up procedure in Chapter 4.

HIM Description

When the Drive mounted HIM is supplied, it will be accessible from the front of the Drive as shown in Figure 3.1. The HIM has two main functions:

- To provide a means of programming the Drive and viewing operating parameters.
- To allow different Drive functions to be controlled.

The HIM is divided into two sections; Display & Programming Panel and Control Panel. The Display Panel provides a means of programming the Drive and viewing the various operating parameters. The Control Panel allows you to control different drive functions.

IMPORTANT: The operation of some HIM functions will depend upon parameter settings.

Figure 3.1
Human Interface Module Sections

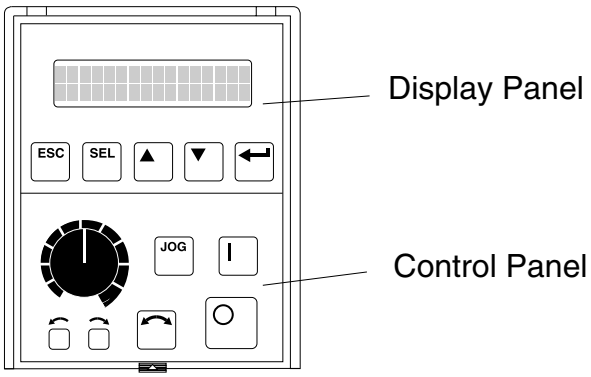


Figure 3.2
HIM Front Panel

Key Descriptions

Descriptions of the keys used with the 1397 Drive are presented in the following paragraphs.

Escape
When pressed, the ESCape key will cause the programming system to go back one level in the menu tree.

Select
Pressing the SELect key alternately causes the top or bottom line of the display to become active. The flashing first character indicates which line is active.

Increment/Decrement
These keys are used to increment and decrement a value or scroll through different groups or parameters.

Enter
When pressed, a group or parameter will be selected or a parameter value will be entered into memory. After a parameter has been entered into memory, the top line of the display will automatically become active, allowing another parameter (or group) to be chosen.

Run
By default, this key will initiate Drive operation if hardware is enabled, (ie. Drive is ready and no other control devices are sending a Stop command. To change this function, the **[Start Mask]** (P. 201) or **[Logic Mask]** (P 207) parameter must be reconfigured. Refer to Chapter 5. If the Drive is jogging or already running, the key has no effect.

Stop
When pressed, a stop sequence will be initiated, causing a controlled stop to occur, as determined by **[Stop Mode Type]** (P. 115). The HIM also sends a "Fault Clear" which can be masked.

Jog
By default, when this key is pressed the motor will jog at a speed determined by the **[Jog Reference]** (P. 093) parameter. Releasing the key will cause the motor to ramp to zero and the contactor will open based on **Jog Off Dly Time** (P. 094).

Change Direction (**Key Active Only on Regen Drives with [Reverse Disable] set to off and [Encoder Quad] to ON.**
Pressing this key will cause the motor to change direction. The appropriate Direction Indicator will light to indicate direction.

Direction LEDs (Indicators)
These LEDs will illuminate to indicate the direction of motor rotation. **[Direction Mask]** (P. 202) and **[Logic Mask]** (P. 207) must be set to allow HIM control of direction change.
If both of these LED's are lit, the one that is steadily lit indicates the commanded direction, while the flashing LED indicates the actual direction.

NOTE: All Run, Jog and Direction keys can also be affected by the [**Logic Mask**] (P. 207). It may be necessary to set or disable parameter 207 when configuring keys.

Up/Down Arrows *(only available with digital speed control)*
Pressing these keys will increase or decrease the HIM reference command. An indication of this command will be shown on the visual Speed Indicator. The Drive will use this reference if the HIM is the selected reference source.

Pressing both keys simultaneously stores the current HIM reference command in HIM memory. Cycling power or removing the HIM from the Drive will set the reference command to the value stored in HIM memory.

If the Analog Speed Potentiometer option has been ordered, the Up/Down keys and Speed Indicator will be replaced by the pot.

Speed Indicator
Illuminates in steps to give an approximate visual indication of the commanded speed.

If the Analog Speed Potentiometer option has been ordered, the Up/Down keys and Speed Indicator will be replaced by the pot.

HIM Operation

When power is first applied to the Drive, the HIM will cycle through a series of displays. These displays will show Drive name, HIM ID number and communication status. Upon completion, the Status Display will be shown.

Figure 3.3
Status Display

This display shows the current status of the Drive (i.e. "Ready," "Running," etc.) or any faults that may be present. The Status Display can be replaced by the Process Display or Password Login menu. See appropriate sections on the following pages for more information.

From this display, pressing any key will cause "Choose Mode" to be displayed. Pressing the Increment or Decrement keys will allow different modes to be selected as described on the pages that follow.

Display
When selected, the Display mode allows any of the parameters to be viewed. However, parameter modifications are not allowed.

Program
Program mode provides access to the complete listing of parameters available for programming.

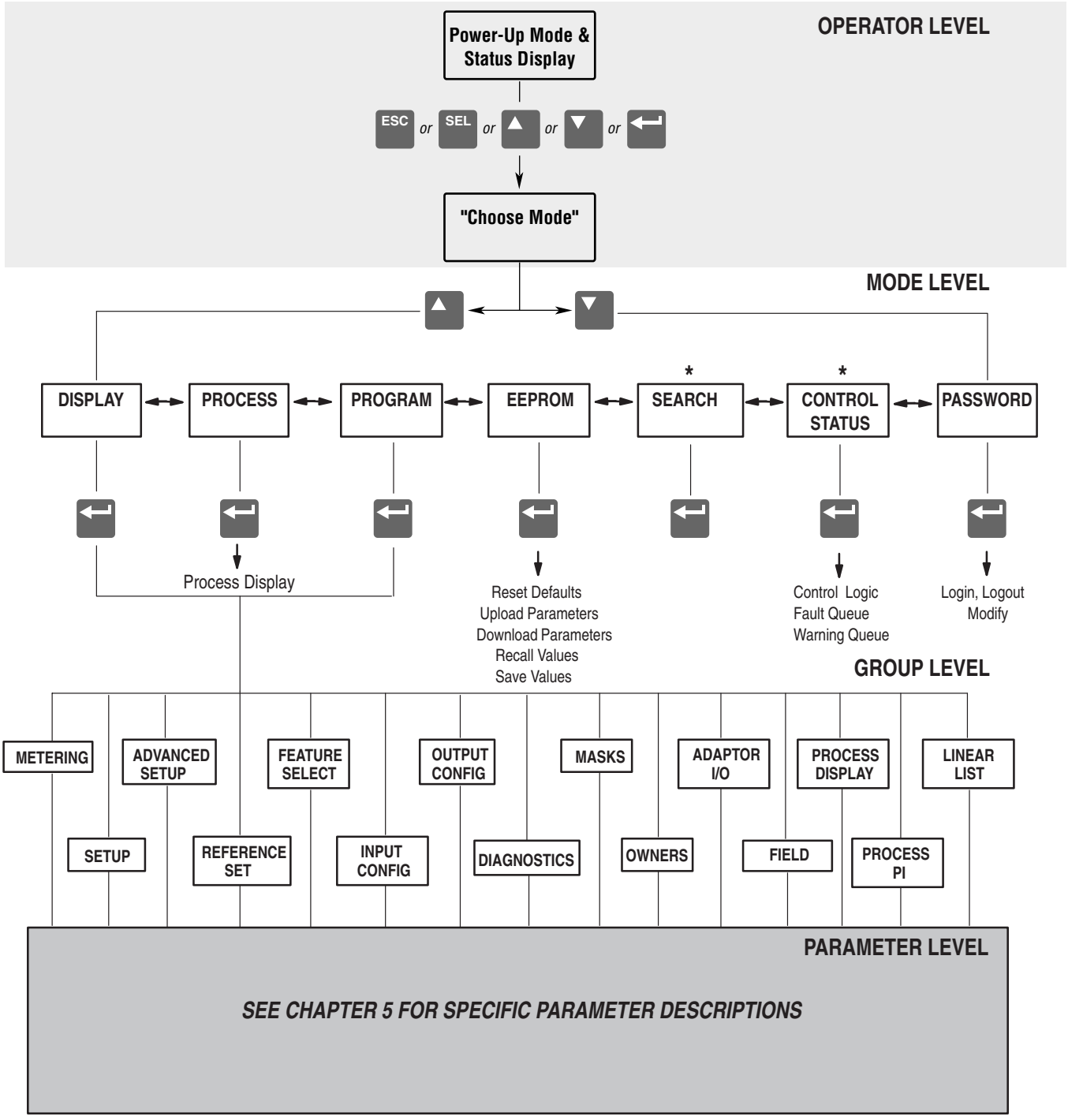
Process
The Process mode displays two user-selected parameters with text and scaling programmed by the user.

Search (Available on Series B HIM only)
This mode will search for parameters that are not at their default values.

Control Status (Available on Series B HIM only)
Permits the drive logic mask to be disabled/enabled allowing HIM removal while Drive power is applied. This menu also provides access to a fault queue and a warning queue which will list the last ten faults or alarms, respectively that have occurred. "Trip" displayed with a fault indicates the actual fault that tripped the Drive. A clear function clears the queue – it will also clear an active fault/alarm condition.

Password
The Password mode protects the Drive parameters against programming changes by unauthorized personnel. When a password has been assigned, access to the Program/EEProm modes and the Control Logic/Clear Fault Queue menus can only be gained when the correct password has been entered. The password can be any five digit number between 00000 and 65535.

FIGURE 3.4
1397 HIM Programming Steps



* Series B HIM (or later) only

Program and Display Modes

1. The Display and Program modes allow access to the parameters for viewing or programming.

A. From the Status Display, press Enter (or any key). “Choose Mode” will be shown.

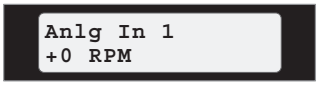
B. Press the Increment (or Decrement) key to show “Program” (or “Display”).

C. Press Enter.

D. Press the Increment (or Decrement) key until the desired group is displayed.

E. Press Enter.

F. Press the Increment (or Decrement) key to scroll to the desired parameter.

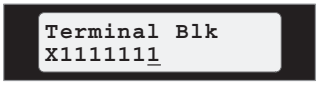


Bit ENUMs

Bit ENUMS (16 character text strings) will be displayed to aid interpretation of bit parameters.

G. Select a bit parameter with the Increment (or Decrement) keys.

H. Press the SELect key to view the ENUM of the first bit. Pressing this key again will move the cursor to the left one bit.



A blinking underline cursor will indicate that you are in the Display mode or that a Read Only parameter has been accessed. A flashing character will indicate that the value can be changed.

Individual bits of a Read/Write parameter can be changed in the same manner. Pressing the SELect key will move the cursor (flashing character) one bit to the left. That bit can then be be changed by pressing the Increment/Decrement keys.

Process Mode

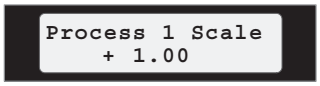
1. When selected, the Process mode will show a custom display consisting of information programmed with the Process Display group of parameters.

A. Follow steps A-C on the preceding page to access the Program mode.

B. Press the Increment/Decrement key until "Process Display" is shown. Press Enter.

C. Using the Increment/Decrement keys, select [Process 1 Par] and enter the number of the parameter you wish to monitor. Press Enter.

D. Select [Process 1 Scale] using the Increment/Decrement keys. Enter the desired scaling factor. Press Enter.



E. Select [Process 1 Txt 1] using the Increment/Decrement keys. Enter the desired text character. Press Enter and repeat for the remaining characters.

F. If desired, a second display line can also be programmed by repeating steps A-E for [Process 2 xxx] parameters.

G. When process programming is complete, press ESCape until "Choose Mode" is displayed. Press Increment/ Decrement until "Process" is displayed.

H. Press Enter. This selects which custom display will be on line 1 and line 2. Use the Increment/Decrement keys to select process 1 or 2 parameters for line 1.

I. Press SELect to move to line 2. Select the desired process parameters. A zero can be entered to disable line 2. In addition, the Process Display can be set to appear when Drive power is applied by simultaneously pressing the Increment and Decrement keys while the Process Display active.

Sets Process Display as Power-Up Display

EEProm Mode

The EEProm mode is used to restore all settings to factory default values or upload/download parameters between the HIM and Drive.

Reset Defaults

1. To restore factory defaults:

A. From the Status Display, press Enter (or any key). “Choose Mode” will be displayed.

B. Press the Increment (or Decrement) key until “EEProm” is displayed. If EEProm is not in the menu, programming is password protected. Refer to *Password Mode* later in this section.

C. Press Enter.

D. Press the Increment (or Decrement) key until “Reset Defaults” is displayed.

E. Press Enter to restore all parameters to their original factory settings.

F. Press the Stop key to reset the fault, if one occurs.

Drive –> HIM

2. To upload a parameter profile from the Drive to the HIM:

A. From the EEProm menu (see steps A-C above), press the Increment/Decrement keys until “Drive –> HIM” is displayed.

B. Press Enter. A profile name (up to 14 characters) will be displayed on line 2 of the HIM. This name can be changed or a new name entered. Use the SEL key to move the cursor left. The Increment/ Decrement keys will change the character.

Drive –> HIM *(continued)*

C. Press Enter. An informational display will be shown, indicating the Drive type and firmware version.

```
1397 DC Drive
Version 1.00
```

D. Press Enter to start the upload. The parameter number currently being uploaded will be displayed on line 1 of the HIM. Line 2 will indicate total progress. Press ESC to stop the upload.

```
Drive -> HIM 60
|||||
```

E. "Completed" displayed on line 2 will indicate a successful upload. Press Enter. If "ERROR" is displayed, see Chapter 6.

```
Drive -> HIM 210
Completed
```

HIM –> Drive

3. To download a parameter profile from the HIM to a Drive:

Important: The download function will only be available when there is a valid profile stored in the HIM.

A. From the EEProm menu (see steps 1A-1C), press the Increment/Decrement keys until "HIM –> Drive" is displayed.

```
EEprom
HIM -> Drive
```

B. Press the Enter key. A profile name will be displayed on line 2 of the HIM. Pressing the Increment/Decrement keys will scroll the display to a second profile (if available).

```
HIM -> Drive
1 A
```

C. Once the desired profile name is displayed, press the Enter key. An informational display will be shown, indicating the version numbers of the profile and drive.

```
Master Type
2.01 -> 2.03
```

D. Press Enter to start the download. The parameter number currently being downloaded will be displayed on line 1 of the HIM. Line 2 will indicate total progress. Press ESC to stop the download.

```
HIM -> Drive 60
|||||
```

E. A successful download will be indicated by "Completed" displayed on line 2 of the HIM. Press Enter. If "ERROR" is displayed, see Chapter 6.

```
Drive -> HIM 210
Completed
```

NOTE: After downloading the parameter profile, the data is NOT automatically saved. Perform a "Save" to save parameters to non-volatile memory.

Save Values

1. To save values in the EEProm Mode:

A. Use the ESCape key if necessary to reach the "Choose Mode" display.

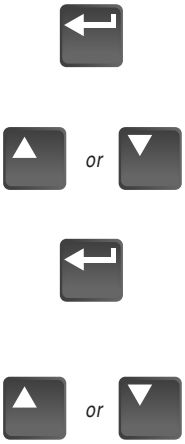
B. Press the Increment (or Decrement) key until "EEProm" is displayed.

C. Press Enter.

D. Press the Increment (or Decrement) key until "Save Values" displayed.

E. Press Enter to save values.

Search Mode



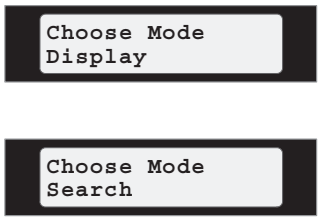
1. This mode allows you to search through the parameter list and display all parameters that are not at the factory default values.

   A. From the Status Display, press Enter (or any key). “Choose Mode” will be shown.

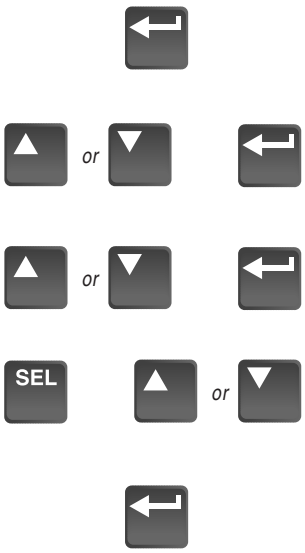
   B. Press the Increment (or Decrement) key until “Search” is displayed.

   C. Press Enter. The HIM will search through all parameters and display any parameters that are not at their factory default values.

   D. Press the Increment (or Decrement) key to scroll through the list.



Control Status Mode



1. This mode allows the Drive logic mask to be disabled, thus preventing a Serial Fault when the HIM is removed with Drive power applied.

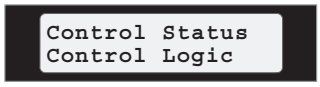
   A. From the Status Display, press Enter (or any key). “Choose Mode” will be shown.

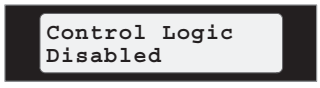
   B. Press the Increment (or Decrement) key until “Control Status” is displayed. Press Enter.

   C. Select “Control Logic” using the Increment/Decrement keys. Press Enter.

   D. Press the SELect key, then use the Increment (or Decrement) key to select “Disabled” (or “Enable”).

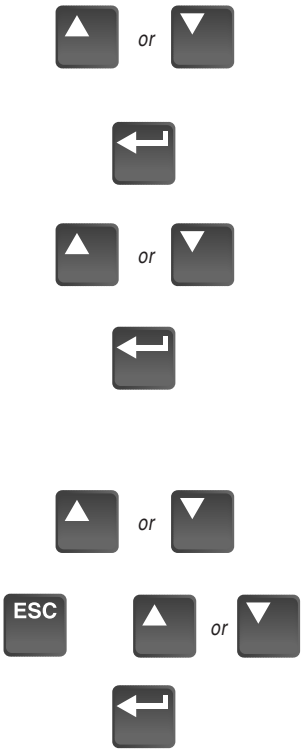
   E. Press Enter. The logic mask is now disabled (or enabled).





Control Status Mode ***(continued)***

Fault Queue/Clear Faults



2. This menu provides a means to view the fault queue and clear it when desired.

F. From the Control Status menu, press the Increment (or Decrement) key until "Fault Queue" is displayed.

G. Press Enter.

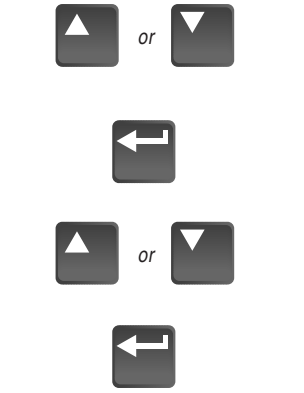
H. Press the Increment (or Decrement) key until "View Faults" is displayed.

I. Press Enter. The fault queue will be displayed. "Trip" displayed with a fault will indicate the fault that tripped the drive.

J. Use the Increment (or Decrement) key to scroll through the list.

K. To clear the fault queue, press ESCape. Then use the Increment/Decrement keys to select "Clear Queue." Press Enter. Please note that "Clear Queue" will also clear active fault conditions.

Warning Queue/Clear Warning



3. This menu provides a means to view the Warning queue and clear it when desired.

L. From the Control Status menu, press the Increment (or Decrement) key until "Warning Queue" is displayed.

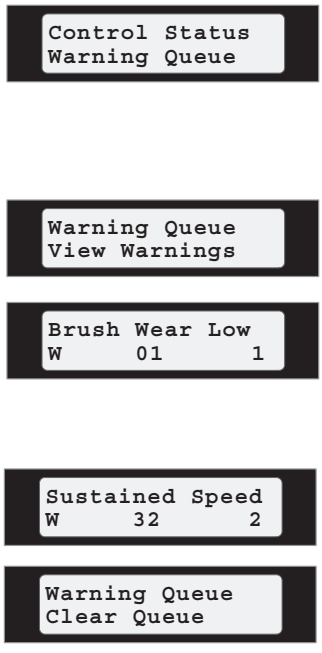
M. Press Enter.

N. Press the Increment (or Decrement) key until "View Warnings" is displayed.

O. Press Enter. The Warning queue will be displayed. "Trip" displayed with a fault will indicate the fault that tripped the drive.

P. Use the Increment (or Decrement) key to scroll through the list.

Q. To clear the Warning queue, press ESCape. Then use the Inc/Dec keys to select "Clear Queue." Press Enter. Please note that "Clear Queue" will also clear active warning conditions.



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Start–Up and Adjustment

Introduction

This chapter is a detailed step-by-step procedure for the proper start up and tuning of the 1397 drive. Among the procedures to be performed in this chapter are the following:

- Verify Wiring
- Verify proper supply voltages.
- Calibrate drive set-up parameters.
- Set jumper switches
- Execute drive tuning procedures.

The Start Up checklist should be used to record all data.

ATTENTION: Servicing energized industrial control equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Hazardous voltages may exist in the cabinet even with the circuit breaker in the off position. Recommended practice is to disconnect and lock out control equipment from power sources, and discharge stored energy in capacitors, if present. If it is necessary to work in the vicinity of energized equipment, the Safety Related Practices of NFPA 70E, “ELECTRICAL SAFETY FOR EMPLOYEE WORKPLACES” must be followed. DO NOT work alone on energized equipment!

ATTENTION: Potentially fatal voltages may result from improper useage of an oscilliscope and other test equipment. The oscilliscope chassis may be at potentially fatal voltage if not properly grounded. If an oscilliscope is used to measure high voltage waveforms, use only a dual channel oscilliscope in the differential mode with X-100 probes. It is recommended that the oscilliscope be used in the A minus B Quasi-differential mode with the oscilliscope chassis grounded to an earth ground. Refer to equipment safety instructions for all test equipment before using with the 1397.

ATTENTION: Only qualified personnel familiar with the 1397 DC Drive and its associated machinery should plan and implement the installation, startup and subsequent maintenance of the Drive. Failure to comply may result in personal injury and/or equipment damage.

Required Tools & Equipment

The following equipment is required for start-up and tuning.

- Multimeter capable of 1000V DC/750V AC, with input resistance of at least 1 megohm.
- Test leads for multimeter
- Assorted screwdrivers (Phillips and blade) and a set of open end wrenches.
- Clamp on Ammeter (AC and DC with current ratings to match Drive ratings)
- Programming Terminal (HIM or GPT)

Recommended Tools & Equipment

The following equipment is recommended for start-up and tuning.

- Dual trace oscilliscope with A minus B quasi differential capability
- X100 probes for oscilliscope

ATTENTION: Do Not use a megohmmeter for continuity checks in the Drive. The high voltage of the megohmmeter can damage the Drive's electronic circuits. Failure to observe this precaution could result in damage to, or destruction of equipment.

General

Only qualified electrical technicians and/or electrical engineers familiar with solid state controls and circuitry should attempt a 1397 start-up. It is imperative that personnel familiarize themselves with the functional description portion of this manual.

The Drive employs regulator construction and uses a keypad for Drive setup, including parameter adjustments and unit selection, monitoring, and diagnostics. Reference, feedback, and metering signals can be interfaced to the Drive. The Drive can be controlled locally by the Human Interface Module (HIM) keypad or remotely by using the terminals at the regulator board terminal strip.

Drive Hardware Adjustments

Control Transformer Settings

Figure 4.1
Control TransformerTap Settings
100-150 HP @ 230 VAC
200-300 HP @ 460 VAC

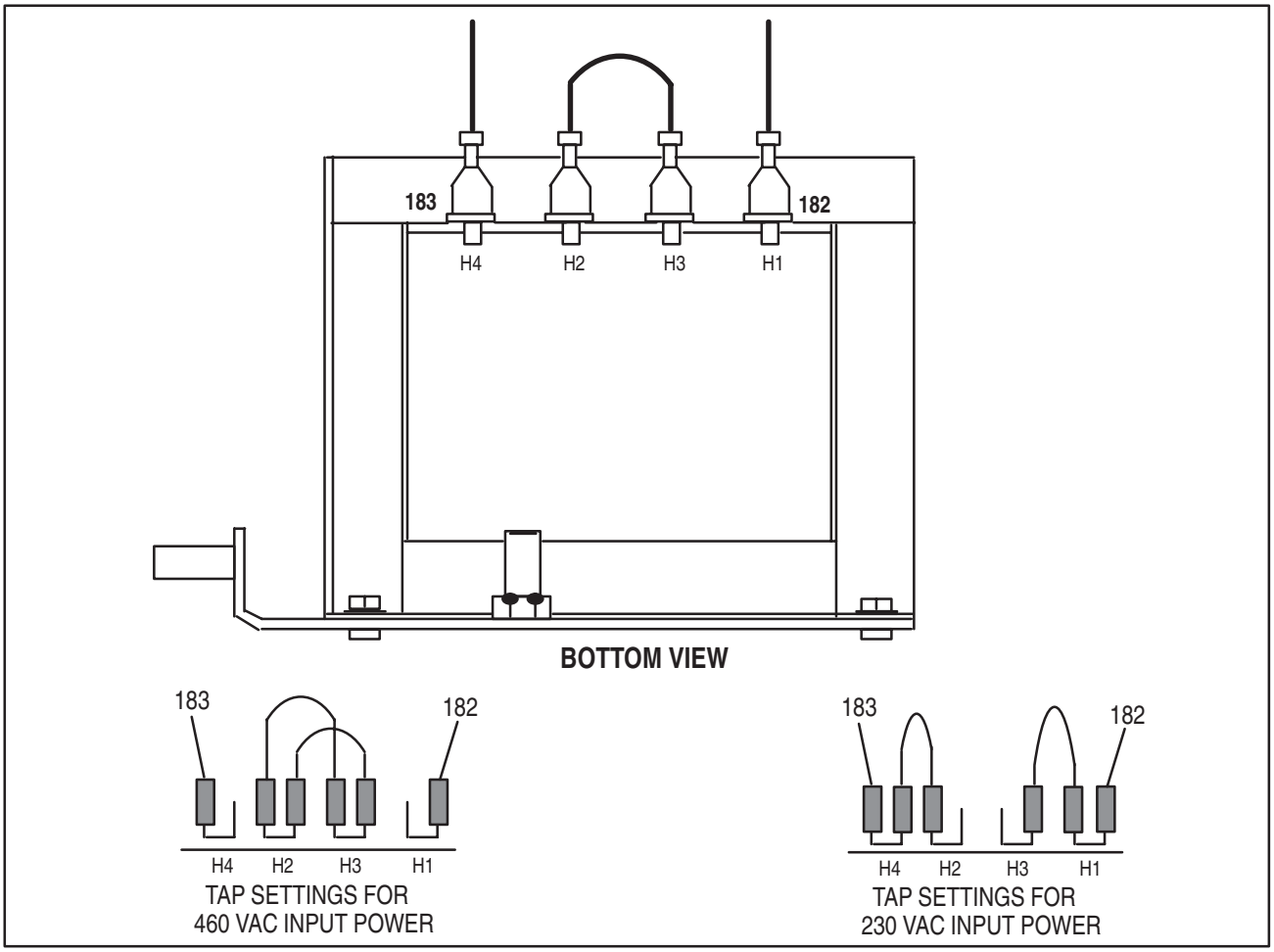
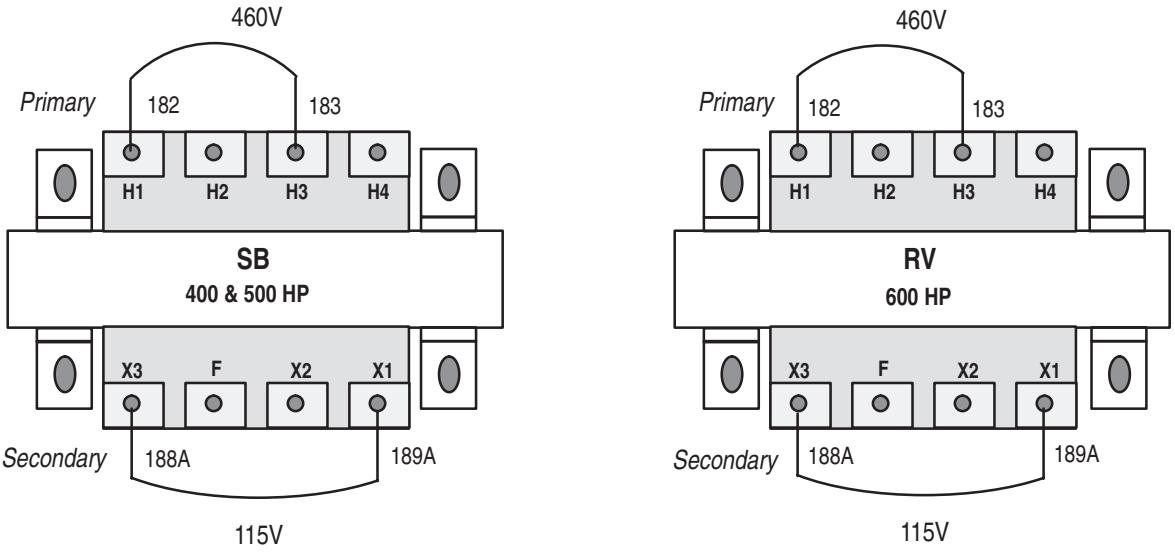


Figure 4.2
Control TransformerTap Settings
400-600 HP @ 460 VAC



Converting a 300 HP 1397 Drive from 460 to 230 VAC Line Input

Unlike lower horsepower units, 200-300 HP 1397 Drives can be converted from 460VAC input to 230 VAC input without the use of a conversion kit. To convert a 300 HP Drive perform the following steps:

- Disconnect and lock out all incoming power to the Drive.
- Disconnect the jumpers between H2 and H3 on the control transformer as shown in Figure 4.3.
- Use the jumpers that were removed to connect H1 to H3 and H4 to H2, as shown in Figure 4.3.
- Reconnect power to the Drive.
- Access parameter 51 [**Nominal AC Volt**], Set the value to 230.

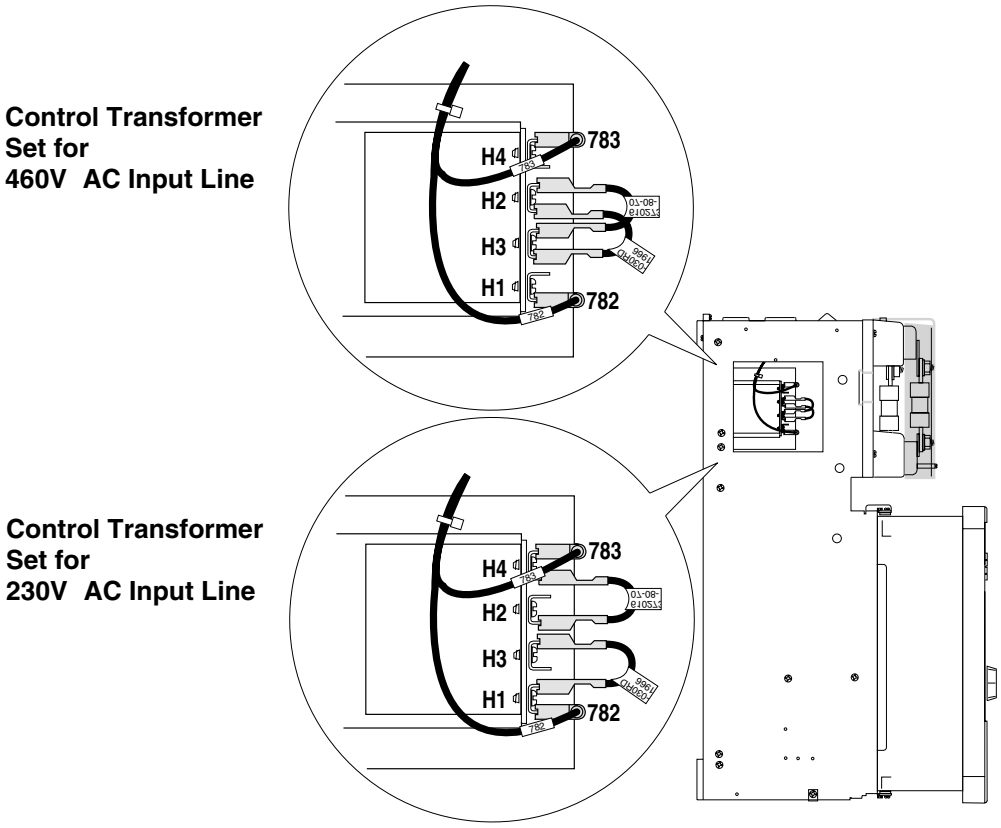
Converting a 600 HP 1397 Drive from 460 to 230 VAC Line Input

Converting a 600 HP Drive from 460 to 230VAC input is NOT recommended.

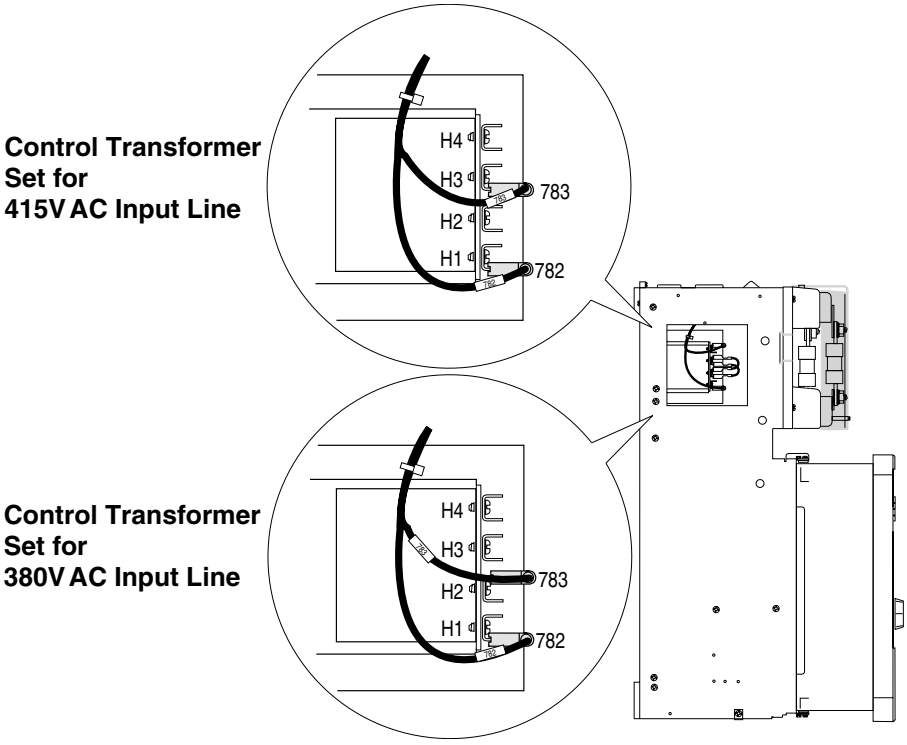
A 600 HP 1397 Drive operating off a 230VAC line input may not have sufficient voltage for the field supply.

Figure 4.3
Control Transformer Settings — 230/380/415/460 V AC Drives

for HP Rated Drives



for Current Rated Drives



Motor Ground Check

ATTENTION: A megohmeter can be used for this ground check, but all conductors between the motor and the Drive must be disconnected. The megohmeter's high voltage can damage the Drive's electronic circuits. Disconnect all conductors between the motor and Drive before using a megohmeter for this motor ground check. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The DC motor frame and conduit box should be connected to a good earth ground per the motor instruction.

Verify that there is no path to ground in either the DC motor armature circuit, the shunt field circuit or the thermostat circuit. Connect one lead of an ohmmeter to the motor frame and the other lead to the two armature leads, then to the two field leads and to the two thermostat leads. If a reading of less than 100,000 ohms is observed, a ground condition exists and MUST be corrected before power is applied.

Pre–Power Checks

Verify that the Drive has been installed and wired per the installation instructions listed in Chapter 2, Installation. Of particular importance are the following:

- Drive Mounting
- Safety Grounds
- General Wiring
- Secure mounting of all connections and components

ATTENTION: Failure to follow wiring guidelines set forth in Chapter 2 Installation, may result in machine malfunction or personal injury.

Record Data

To assist with Start-Up, the information listed in the Pre-Power Checklist Table must be recorded. This information includes:

- Drive Nameplate Data.
- Motor Nameplate Data.
- Tach/Encoder Data (if applicable).
- Field Supply Type.
- Installed drive options such as AC line disconnects, dynamic braking, etc.

IMPORTANT: Record all Regulator Board & Option jumper settings for future reference when replacing parts.

Table 4.A
Pre-Power Checklist

DRIVE NAMEPLATE DATA: _____

Catalog Number: _____

M/N: _____

Ser: _____

AC Input: _____ Volts _____ Amps

DC Output : _____ Volts _____ Amps

DC Field: _____ Volts _____ Amps

Short Circuit Rating: _____ Amps

HP: _____

MOTOR NAMEPLATE DATA:

Manufacturer: _____

Model Number: _____

Serial Number: _____

Type: _____

HP: _____

RPM: _____

Arm _____ Volts _____ Amps

Field _____ Volts _____ Amps

Wound Type: _____

Frame: _____

TACHOMETER/ENCODER NAMEPLATE DATA:

Manufacturer: _____

Model Number: _____

Serial Number: _____

Type: _____

Rated Supply Voltage (encoder only): _____ Volts

Rated Output Voltage

Encoder _____ Volts square wave

Encoder Pulse per Revolution (PPR) _____

DC Tach _____ Volts at _____ RPM

OPTION NAMEPLATE DATA:

Manufacturer: _____

Model Number: _____

Serial Number: _____

Type: _____

FIELD SUPPLY DATA:

Volts: _____

Type: _____

Field Supply Configuration

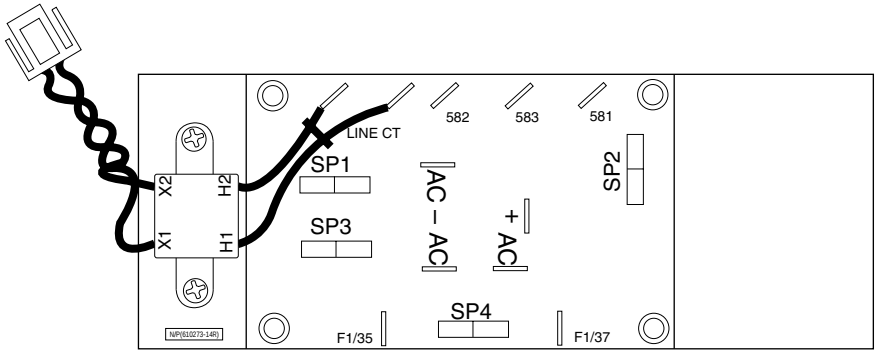
Verify which shunt field supply has shipped with your Drive. Configuration procedures will vary depending on field supply type.

ATTENTION: Field Supply configuration must be checked while making the Pre-Power Checks. If your Drive uses either the optional Enhanced Field Supply or the Regulated Field Supply, different configuration procedures are required than with the Standard Field Supply. Power should not be applied to the motor field windings prior to adjusting these parameters, as outlined in the respective field supply's installation manual. Failure to properly configure your field supply could cause the motor to run at excessive speed or damage the motor which could result in personal injury or destruction of equipment.

Standard Field Supply (See Note Below)

If the Standard Field Supply (Fig. 4.4) is installed, adjustment is not necessary.

Figure 4.4
Standard Field Supply Terminations

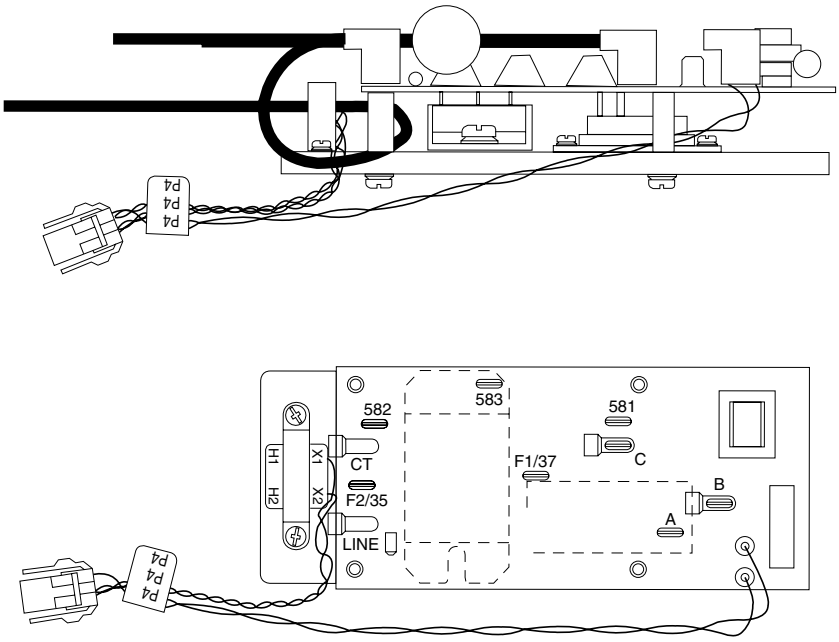


Note: Regulated Field Supply is provided as standard on:
230V Drives with ratings above 45 kW (60 Hp)
460V Drives with ratings above 112 kW (150 Hp)
380/415V Drives with ratings above 35.8 kW (48 Hp)

Enhanced Field Supply

The Enhanced Field Supply (Fig. 4.5) allows adjustment of the field voltage through hardware jumper settings and parameter adjustment. Prior to applying the Enhanced Field Supply output to the DC motor's field windings, the output voltage must be adjusted so that it doesn't exceed the rated motor field voltage. This procedure is described in the Enhanced Field Supply Kit Installation manual, Publication 1397-5.12.

Figure 4.5
Enhanced Field Supply

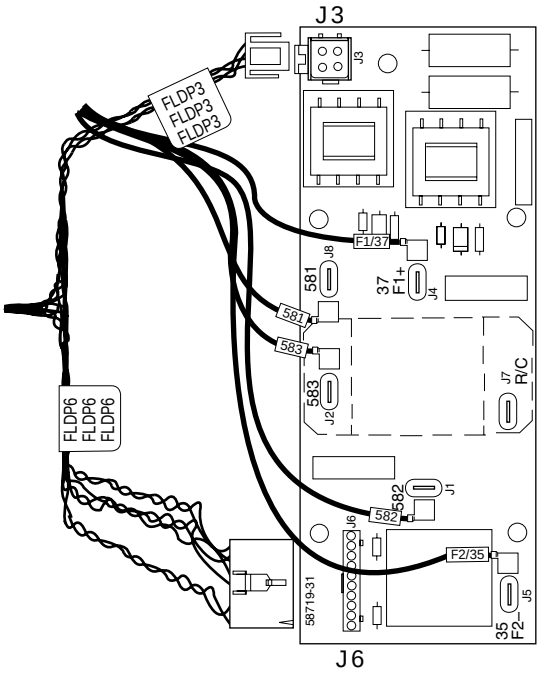


ATTENTION: It is imperative that the Drive NOT BE STARTED with the field windings in the un-powered condition. Failure to follow these procedures may result in a machine malfunction and/or personal injury.
The output voltage and current of both the enhanced field supply and the regulated field supply are determined by the values contained in set-up parameters.

Regulated Field Supply

The Regulated Field Supply (Fig. 4.6) allows the motor to run above base speed (i.e. to operate in the constant horsepower range) by weakening the motor field current. Prior to applying the regulated field supply output to the DC motor's field windings, the output current must be adjusted so that it does not exceed the rated motor field current. This procedure is described in the Regulated Field Supply Kit Installation manual, Publication 1397-5.17.

Figure 4.6
Regulated Field Supply Terminations



Pre-Power Verification

ATTENTION: Prior to energizing the Drive, it is imperative that the installation instructions in Chapter 2 and the Pre-Power checks listed in the previous section be completely accomplished. No attempt to apply power should be made if the installation is in question. Failure to properly install and configure the Drive or options could result in personal injury and/or equipment damage.

Additionally, you must verify that all Drive options are properly configured for their intended application. These options include, but are not limited to:

OPTION	INSTALLATION MANUAL
• Enhanced Field Supply	1397 – 5.24
• Regulated Field Supply	1397 – 5.17
• 60 HP AC Line Disconnect	1397 – 5.11
• Dynamic Braking	1397 – 5.14
• Pulse Encoder Interface	1397 – 5.13
• Expansion I/O	1397 – 5.19
• AC Tach Interface	1397 – 5.22
• 460/230V Fuse Kit	1397 – 5.16
• Blower Motor Starter	1397 – 5.20
• 150 HP AC Line Disconnect	1397 – 5.21
• 115VAC Control Int Bd	1397 – 5.18
• Inverting Fault C.B. Kit	1397 – 5.29
• AC Line Disconnect Kit	1397 – 5.30
• AC Line Filter Kit	1397 – 5.31

Ensure that the Coast/Stop input between terminals TB-7 and TB-8 of the Regulator Board is locked in the open state.

If the Drive is equipped with an optional AC disconnect, verify that the disconnect is in the open position.

Record the motor field polarity in Table 4.B, as terminated at terminals F1 and F2 of the field terminal strip (Figures 4.7 & 4.8).

Figure 4.7
DC Motor Field Connection Location
1.5-30 HP at 230 VAC
7-110A @ 380/415 VAC
3-60 HP at 460 VAC

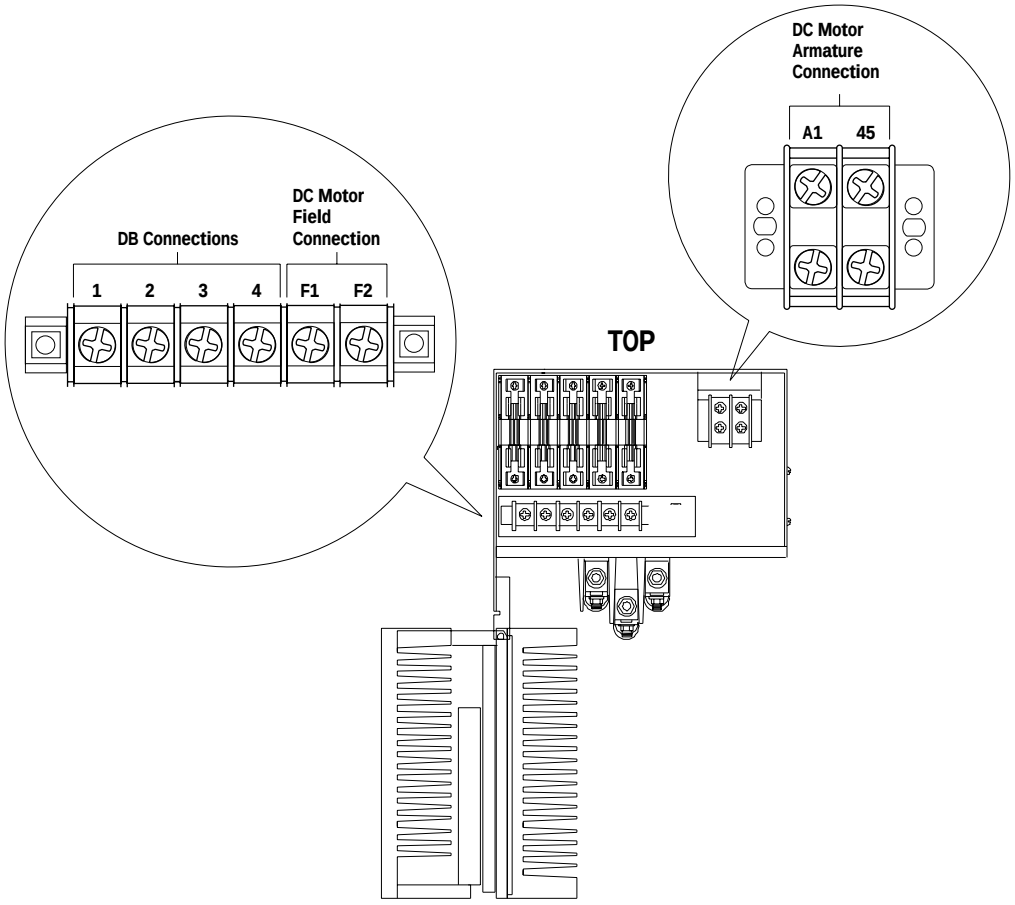
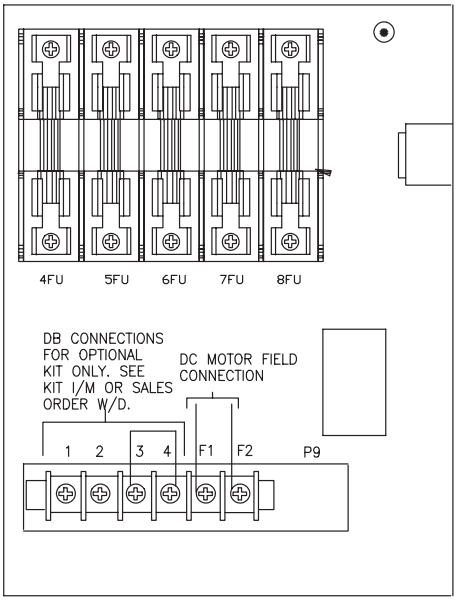
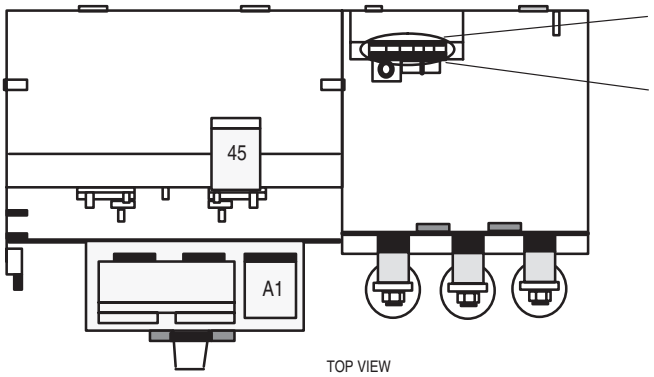


Figure 4.8
DC Motor Field Connection Location

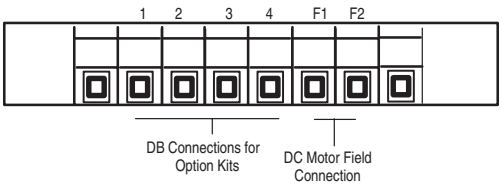


TOP VIEW

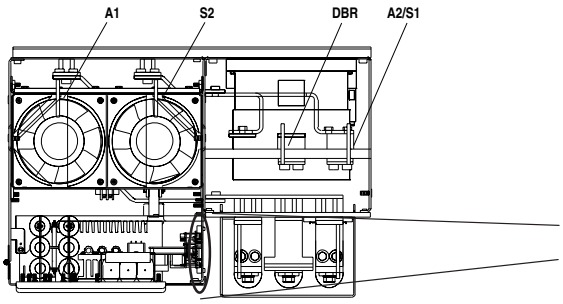
40 – 75HP at 230 VAC
265A @ 380/415 VAC
75 – 150 HP at 460 VAC



TOP VIEW



100 – 150 HP at 230 VAC
200 – 300 HP at 460 VAC



TOP VIEW

400 – 600 HP at 460 VAC

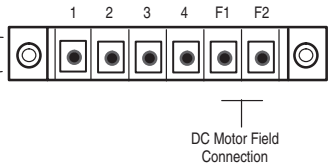


Table 4.B
Motor Field Connections

Drive Terminal	Wire No	Motor Terminal
F1 (+)		
F2 (–)		

Power-On Checks

Power Application

ATTENTION: The following start-up procedure must be performed with power applied to the Drive. Some of the voltages present are at incoming line potential. To avoid electric shock hazard or damage to equipment, only qualified service personnel should perform the following procedure. Throughly read and understand the procedure before beginning. If an event does not occur while performing this procedure, DO NOT PROCEED. REMOVE POWER by opening the branch circuit disconnect device and correct the malfunction before continuing.

Apply power to the Drive. If you are using a HIM programming device, the Drive will display the following screen for several seconds during power-up.

IMPORTANT: If the Drive detects a fault, a statement relating to the fault will be shown on the display. Record this information, remove all power and correct the fault source before proceeding.

Drives without AC Line Disconnect

Apply the main power source feeding the Drive, and measure the voltage present between terminals.
L1 and L2 (181 – 182)
L1 and L3 (181 – 183)
L2 and L3 (182 – 183)
Record the measurements in Table 4.C:

Table 4.C
Rated Drive Voltage (No Disconnect Option)

Test Points	Expected Value	Measured Value
L1 to L2	Rated AC Voltage (230/380/415 /460V)	
L1 to L3	Rated AC Voltage (230/380/415/460V)	
L2 to L3	Rated AC Voltage (230/380/415/460V)	

Drives with AC Line Disconnect

Apply the main power source feeding the Drive, and energize the Drive by closing the Drive's AC line disconnect. Measure the voltage present between the terminals on the load side of the disconnect:
81 and 82
81 and 83
82 and 83
Record the measurements in the following table:

Table 4.D
Rated Drive Voltage (With Disconnect Option)

Test Points	Expected Value	Measured Value
81 to 82	Rated AC Voltage (230/380/415/460V)	
81 to 83	Rated AC Voltage (230/380/415/ 460V)	
82 to 83	Rated AC Voltage (230/380/415/ 460V)	

In all cases, the three-phase input voltage should be equal to the rated Drive AC input voltage +/–10%. If the voltage is not within tolerance, verify that the Drive rating is correct or perform the necessary adjustments to the incoming line voltage so that it complies with the Drive rating.

Parameter Set–Up

All Drives are shipped with factory default parameter settings. Before making any parameter changes, review Chapter 5, Programming Parameters. Parameter values are changed using the Human Interface Module (HIM). Before beginning any changes become throughly familiar with the HIM.

ATTENTION: Before starting this procedure, make certain that the Coast-to-Stop input is locked in the open state. The Drive's AC contactor must remain open while the parameter set-up is being performed. Failure to maintain the input and contactor in the open state could lead to unintended motor or process equipment operation and subsequent damage.

ATTENTION: Only qualified electrical personnel familiar with the construction and operation of electrical equipment and the hazards involved should install, adjust, operate, and/or service this equipment. Read and understand this section entirely before proceeding. Failure to observe this precaution could result in bodily injury or loss of life.

Table 4.E provides a description of the parameters which must be properly configured prior to operating the Drive. Unless otherwise noted, these parameters are located in the Set-Up group. Scroll through the Set-Up group and set the parameters based on the application. For additional information, refer to Chapter 5, Programming Parameters. For information on operation of the Human Interface Module, see Chapter 3, Programming.

ATTENTION: The 1397 control circuitry includes solid-state components. If hazards due to accidental contact with moving machinery or unintentional flow of liquid, gas or solids exist, an additional hardwired stop circuit may be required (in addition to the required hard wired Coast-to-Stop circuit) to remove AC line power to the Drive. When AC input power is removed, there will be a loss of inherent regenerative braking effect and the motor will coast to a stop. An auxiliary braking method may be required.

IMPORTANT: Use the EEPROM mode in the programming terminal to save all parameter changes to EEPROM or they will be lost when power is removed from the Drive.

ATTENTION: The incorrect setting of Setup parameters can cause an overspeed condition. These parameters must be set by a qualified person who understands the significance of setting them. Verify that the value of these parameters are set accurately for your application requirements. Failure to observe this precaution could result in personal injury or equipment damage.

Table 4.E
Parameter Modification Sequence

Parameter Name	Par. No.	Default	Description	User Setting
[Stop Mode Type] **[Stop Speed Level]** ***Feature Select Group***	**P.115** **P.116**	Coast	P.115 Selects stopping mode of the Drive in response to a normal Stop command. P.116 sets the threshold speed below which the main contactor will automatically open after a ramp stop or current limit stop is asserted. This value should be less than or equal to [Min Process Speed]. [Stop Mode] default is Coast. If you wish to change modes, exit the Set Up menu and select Stop Mode. Change the default to Ramp or Limit and then set the [Stop Speed Level] in parameter 116.	
[Max Motor Speed] ***Setup Group***	**P.041**	500 RPM	**[Max Motor Speed]** is the highest normal running speed of the motor. This parameter scales the feedback device. **[Max Motor Speed]** depends on several factors: ● If there is no field weakening, the top speed is typically the same as the nameplate base speed. ● If there is field weakening, the top speed is the same as the field weakened speed. Top speed is typically more than the base speed when field weakening is applied.	
[Motor Arm Amps] ***Setup Group***	**P.045**	8.0 Amps	**ATTENTION:** The Drive will not operate properly if this parameter value is wrong. This parameter must be equal to the rated armature amps on the motor nameplate. Failure to observe this precaution could result in damage to or destruction of the equipment. The rated armature current from the motor nameplate.	
[Motor Field Amps] ***Setup Group***	**P.044**	0.01 Amps	It only needs to be set if a regulated field supply is installed. Sets the motor rated hot field amps from the motor nameplate. Scales the field current feedback.	
[Motor Arm Volts] ***Setup Group***	**P.046**	240 Volts[1]	The rated armature voltage from the motor nameplate.	
[Feedback Type] ***Setup Group***	**P.039**	Arm Volt[1]	**[Feedback Type]** selects the type of feedback signal that is used for the speed/voltage loop. **[Encoder]** can be selected only if a pulse tachometer kit is installed. **[Feedback Type]** causes the **[Neg Current Lim]** (step 16) to be set to 0 and **[Reverse Disable]** (step 4) to be set to On if: ● AC Tach is selected. ● Pulse Tach is selected and **[Encoder Quad]** is set Off.	
[Anlg Tach V/1000] ***Setup Group***	**P.047**	18 V/1000 RPM[1]	This parameter only needs to be set if **[Feedback Type]** was set to AC Tach or DC Tach. **[Anlg Tach V/1000]** is the analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM. Units are volts DC for DC tachometers or volts AC RMS for AC tachometers. This parameter might be limited to less than 200.0 volts/1000 so that voltage from the tachometer will not be more than 250 V.	
			ATTENTION: Failure to set the Analog Tach Voltage range correctly can cause an overspeed condition.	

Parameter Modification Sequence (cont)

Parameter Name	Par No.	Default	Description	User Setting
[Encoder PPR] ***Setup Group***	**P.048**	18 PPR	This parameter only needs to be set if [Feedback Type] was set to Encoder. **[Encoder PPR]** sets the pulse tachometer pulses per revolution (PPR) from the pulse tachometer nameplate.	
			ATTENTION: The incorrect setting of the Encoder PPR parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.	
[Encoder Quad] ***Setup Group***	**P.049**	On	This parameter only needs to be set if **[Feedback Type]** was set to Pulse Tach. **[Encoder Quad]** enables or disables pulse tachometer quadrature. Set On for a bidirectional pulse tachometer. Set Off for a unidirectional pulse tachometer. If **[Encoder Quad]** is set to Off while Pulse Tach is the selected **[Feedback Type]**, **[Neg Current Lim]** will be set to 0 and **[Reverse Disable]** set to On (preventing reverse direction).	
[Accel Time] ***Setup Group***	**P.037**	5.0 Seconds	The time it takes to accelerate from 0 to **[Max Motor Speed] (P.041)**. Smaller changes in speed take proportionately less time. If **[Trim Mode Type] (P. 117)** is set to Proportional, this time value is modified by **[Draw Percent Out] (P.009)**.	
[Decel Time] ***Setup Group***	**P.038**	5.0 Seconds	**[Decel Time]** selects the time it takes to decelerate from **[Top Speed]** to 0. Smaller changes in speed take proportionately less time. If **[Trim Mode Select]** is set to Proportional, this time value is modified by **[Draw Percent Out]**. Selects the minimum speed of the Drive without being stopped. It is typically greater than zero. If it is less than 10% of **[Maximum Speed]**, an alarm is generated.	
[Max Process Spd] ***Setup Group***	**P.042**	500 RPM	**ATTENTION:** When performing this adjustment, do not allow the motor to exceed the maximum safe speed of the driven equipment as determined by the equipment manufacturer. Failure to observe this precaution could result in bodily injury. The maximum speed of the Drive that can be supported by the application or process. **[Max Process Speed]** can be less than or equal to **[Max Motor Speed]**. If raising this value causes **[Min Process Spd]** to become less than 10% of **[Max Process Spd]**, an alarm is generated.	

[Min Process Spd] ***Setup Group***	**P.043**	250 RPM	**ATTENTION:** This Drive can operate at and maintain zero speed when this parameter is set to zero. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the Drive is operating at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.	
[Nominal AC Freq] ***Setup Group***	**P.050**	60 Hz	Typically, the value of this parameter is 50 or 60 Hz. Use the up/down arrow keys to adjust the value to the nominal value of the line frquency in use. Valid values are 48 to 62 Hz.	
[Nominal AC Volts] ***Setup Group***	**P.051**	230 VAC[1]	Use the up/down arrow keys to adjust the value to the nominal value of the AC line RMS voltage in use. Valid values are 200 – 575 VAC.	
[CT Turns Ratio] ***Adv Setup***	**P.036**	NA*	The Drive Current Transformer Turns Ratio (TP/Tn). *see page 5–22 for instructions on determining a CT Turns final default value.	
[Jog Acc/Dec Time] ***Ref Setup Group***	**P.092**	3.0 Seconds	**[Jog Accel/Decel Time]** is the time it takes the jog reference circuit to reach **[Max Motor Speed]** from zero.	
[Jog Reference] ***Ref Setup Group***	**P.093**	250 RPM	The operating speed when the Drive is jogging.	

NOTES:

[1] Default levels may change based on incoming Voltage levels.

Jumper Settings

The jumper settings for the 1397 Drive determine the regulator type, program protection, field settings, references for automatic and manual modes, tachometer voltage range, and armature feedback scaling.

IMPORTANT: The Diagnostic Parameter group in the 1397 will display the proper jumper configuration you should use for J11, J14 and J18, based on the parameters you have previously entered.

- Through the HIM, check the proper jumper settings for [**J11 Tach VScale**] (P.180), [**J14 Tach V Range**] (P.181), and [**J18 Arm Fdbk Res**] (P.183) in the Diagnostics Menu. Write down the as displayed settings in the Calculated Setting column of Table 4.G and in Table 4.F below. Make sure the actual settings match.

Table 4.F
Regulator Board Hardware Jumper Settings

Hardware Jumper	Location of Recommended Value	Actual Setting
J11	Tach V Scale (P 180)	
J14	Tach V Range (P. 181)	
J18	Arm Fdbk Res (P. 183)	

NOTE: If [**Feedback Type**] (P.039) is not set to DC Tach or AC Tach, the position of J11 and J14 is ignored.

- Through the HIM, check the current settings for [**J15 Reg Type**] (P.182), [**J20 Fld Loss**] (P. 184), and [**J21 Field Supply**] (P.185) in the Diagnostics menu. If these settings are correct for your system, you do not need to change them. Record the settings in in Table 4.G.

Note: Only check these parameters after entering the correct values for the parameters in the setup menu. J11, J14 and J18 are calculated from the setup menu parameters. When all parameter values and jumper settings are completed perform an EEPROM save.

Setting the Jumpers

ATTENTION: This equipment is at line voltage when AC power is connected to the Drive. Disconnect and lock out incoming power to the Drive before proceeding. After power is removed, verify with a voltmeter at power terminals 181, 182 and 183 that no voltage exists before touching any internal parts of the Drive. Failure to observe these precautions could result in severe bodily injury or loss of life.

ATTENTION: Unless explicitly stated otherwise, power must be removed before changing any jumper connection. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

IMPORTANT: Jumpers are read only on powerup, so power must be cycled for a change to a jumper setting to be recognized by the Drive.

To set the jumpers:

1. Remove power from the Drive. Remove the cover. Refer to Chapter 3 for cover removal. You do need to remove the HIM bracket.
2. The jumpers are located on the regulator board as shown in Figure 4.9.
3. Change the jumper settings as described in the following description and record them in the Final Setting column of Table 4.G.

Table 4.G
Jumper and Adjustment Settings

Jumper/Adjustment	Default Setting	Calculated Setting	Final Setting
J15 (Regulator Type)	Speed		
J16 (Program Protection)	*Not Currently Used*		
J20 (Field Loss Detect)	Enable		
J21 (Field Supply Jumper)	N/A [1]		
J19 (Analog Ref 2)	Pot		
J14 (Tach V Range)	62		
J11 (Tach V Scale)	16		
J10 (Analog Ref 1)	Volts		
J12 (Analog Ref 1)	Volts		
J18 (ARM I FB RB)	Position 4		

[1] Only applicable when the optional Enhanced Field Supply kit is installed.

Setting the Regulator Type (Jumper J15)

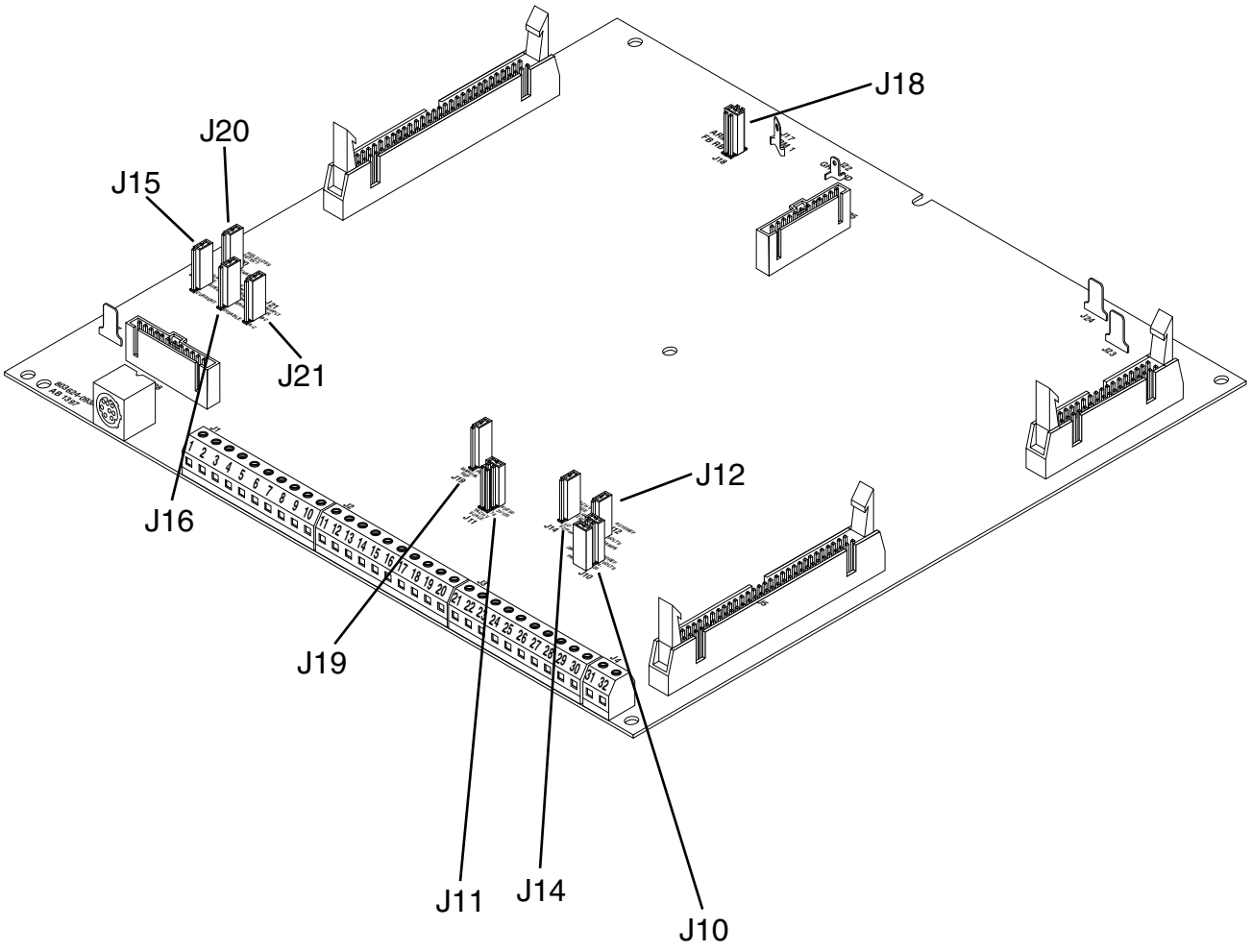
J15 determines whether the Drive uses speed/voltage or torque/current regulation mode. This jumper is read only when the regulator is powered up.

When Current is selected, all speed references become torque references. For example: Analog Ref 1 and Ref 2 are now *Torque References.*

Also note that speed/voltage parameters must be set to provide overspeed protection for the Drive.

ATTENTION: Failure to correctly set speed/voltage parameters could result in dangerously high motor speeds. Failure to provide overspeed protection could result in bodily injury or equipment damage.

Figure 4.9
Regulator Board Jumpers



Setting Field Loss Detection (Jumper J20)

The Field Loss Detect jumper (J20) determines whether or not a fault is generated when a field loss occurs.

IMPORTANT: Jumper J20 is ignored if the Field Current Regulator kit is installed. Therefore, placing J20 in the Disable position will not disable field loss detection. See the instructions supplied with the kit for more information on the Field Current Regulator.

NOTE: Jumper J20 has no effect if the drive is equipped with an enhanced or regulated field supply.

ATTENTION: The user must provide external field current loss detection and inhibit Drive operation via one of the Drive interlocks when Jumper J20 is positioned to disable. Misapplication of this jumper can cause the motor to run at dangerously high speeds. Failure to observe this precaution could result in bodily injury and/or equipment damage.

To detect complete loss of field current, place the jumper on pins 1 and 2 (Enable). When a complete loss is sensed, a fault is generated and the Drive is coast stopped.

To ignore field loss, place the jumper on pins 2 and 3 (Disable). Any loss of field current is ignored. Use the Disable option only when no field exists, such as with a permanent magnet motor or when a separate field supply is used.

IMPORTANT: Jumper J20 has no effect if a Regulated Field Supply is installed. No fault is generated with a Regulated Field Supply.

Setting the Drive for the Enhanced Field Supply (Jumper J21)

IMPORTANT: This jumper has no effect on the standard field supply or the optional Field Current Regulator kit.

The Field Supply Jumper (J21) determines the voltage range that the Drive expects to see from the optional Enhanced Field Supply kit. Refer to the instructions supplied with the kit for more information on the Enhanced Field Supply.

The DC voltage range can be either from 45 to 90% or from 90 to 112.5%.

To set the Drive for a voltage range of 45 to 90%, place the jumper on pins 1 and 2.

To set the Drive for a voltage range of 90 to 112.5%, place the jumper on pins 2 and 3.

Setting the Source for the Anlg Reference 2 (Jumper J19, Manual Ref on board)

ATTENTION: The Drive will not operate at the correct speed if Jumper J19 is not set to the correct position. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The Manual Ref jumper (J19) determines whether the internal +10 V isolated power supply or an external +10 V source is used for Analog Reference 2.

To use the +10V power supply for the Analog Reference 2 potentiometer, place the jumper on pins 2 and 3 (Pot). The supply at terminal 16 of the regulator board terminal strip is used.

To use an external +10 V source, place the jumper on pins 1 and 2 (Ext). The external reference is connected at terminals 17 and 18 of the regulator board terminal strip.

NOTE: This input can be used as a trim on the auto mode speed reference by setting the jumper on pins 1 and 2 (EXT). In this case a ±10 V range can be used.

Setting the Voltage Range and Scale of an Analog Tachometer (Jumpers J14 and J11)

The Tach V Range (J14) and Tach V Scale (J11) jumpers set the voltage range and scale of the analog tachometer.

NOTE: These jumpers are ignored if an analog tach is not used and if **[Feedback Type] (P. 039)** is not set to DC Tach or AC Tach.

Note: Jumper J14 determines which terminal is used for tach connection. Refer to Figure 4.15 for a tach installation illustration. Table 4.H details tach terminations for Lo or Hi speed operation.

ATTENTION: The Drive can overspeed if jumper J14 is set incorrectly, or the tach is wired incorrectly. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

Table 4.H
Regulator Board Terminal Strip Tach Terminations

	Terminal	Terminal
Hi – Range	21	23 (Common)
Lo – Range	22	23 (Common)

During quick start, the Drive calculates the value of the tachometer voltage range based on the values of **[Max Process Speed] (P. 042)** and **[Anlg Tach v/1000] (P. 047)** and the setting of Feedback Select. The correct values are displayed under the Diagnostics menu on the HIM. Verify these jumper settings before performing the auto-tuning procedure.

ATTENTION: The Drive will not operate at the correct speed if jumpers J11 and J14 are not set to the correct positions. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The expected analog tachometer voltage range can be set to a maximum of 250 or 62V DC. Jumper J11 selects the hardware circuitry to maximize the resolution over the entire speed range.

Table 4.I
Regulator Board Jumpers

	Jumper J14	Jumper J11
Top Speed Tach Volts ≤ 16 Volts	Low	16
Top Speed Tach Volts ≤ 31 Volts	Low	31/125
Top Speed Tach Volts ≤ 62 Volts	Low	62/250
Top Speed Tach Volts ≤ 125 Volts	High	31/125
Top Speed Tach Volts ≤ 250 Volts	High	62/250

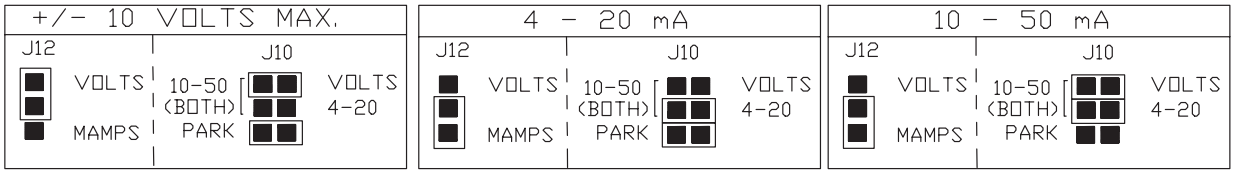
Note: The output voltage of the tachometer must not exceed 250 V for DC tachometers or 275 RMS for AC tachometers when the motor is rotating at **[Max Motor Speed]**. To calculate the output voltage at top speed, multiply the two parameter values:

$$\text{Tach Voltage at [Max Motor Speed]} = \frac{\text{[Max Motor Speed]} \times \text{[Analog Tach v per thousand]}}{1000}$$

Analog Reference 1 Set–up (Jumpers J12, Autoref and J10, Autoref)

The Anlg In 1 jumpers (J12 and J10 Fig. 4.10) select the type of analog reference to be used. J12 selects the type of signal (voltage or milliamps). J10 selects the range.

Figure 4.10
Anlg In 1 Jumper Selection



Scaling the Armature Current Feedback (Jumper 18)

The Arm I FB RB jumper (J18) scales the armature current feedback signal. The Drive calculates the value of the burden resistor needed to scale the armature current feedback signal. The calculations are based on the values of **[Motor Arm Amps] (P.045)** and **Maximum Current (P. 040)**.

ATTENTION: The Drive will not operate at the correct speed if jumpers J10, J12 and J18 are not set to the correct positions for your application. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The HIM displays the correct position of the jumper under the Diagnostics menu **[J18 Arm Fdbk Res] (P.183)**. Verify this jumper setting before performing the self-tuning procedure.

Verify the Correct Operation of 24V I/O Inputs

Table 4.J lists the standard 1397 I/O input points indicating those hardware inputs which are required for Drive operation. Some of these signals may be generated by the terminal strip or a SCANport device or HIM or both. These signals are identified in the table by the column labeled “Alternate Control Source”.

NOTE: Required signals MUST be correctly wired to the terminal strip for proper Drive operation, and cannot be masked. Signals that are not required may be “masked off” for exclusive control by a SCANport device or HIM. Masking parameters are described in detail in Chapter 5: *Programming Parameters*.

IMPORTANT: Regulator Board terminal Strip Inputs 3, 8, 9, 12 and 13 must be closed for the Drive to be ready.

Table 4.J
Standard I/O Functions

I/O Point	Required	Alternate Control Source	Contact Sense	Active Function
Run	No	SCANport/HIM	NO	Start when CLOSED
STOP	YES	SCANport/HIM	NC	Stop when OPEN
Jog	No	SCANport/HIM	NO	Jog when closed
Rev/Fwd	No	SCANport/HIM	NO	Forward = Open Rev = Closed
Reference Select	No	SCANport/HIM	NO	Selects Analog Ref 2 when Open Selects Analog Ref 1 when Closed
Coast to Stop	YES	None	NC	Opens AC or DB Contactor (if installed) when OPEN Motor Coasts to Stop
Customer Interlock	YES	None	NC	Opens AC contactor when OPEN – motor coasts to stop
Fault/Alarm Reset	No	SCANport/HIM	NO	Resets fault / acknowledges alarm when CLOSED
Brush Wear	Yes	None	NC	When OPEN activates warning Motor will still run.
Motor Thermostat	Yes	None	NC	Opens AC contactor when OPEN – motor coasts to stop
Analog Ref 1	No	Scanport/HIM	Analog	External speed reference selected when REF SELECT CLOSED
Analog Ref 2	No	Scanport/HIM	Analog	External speed reference selected when REF SELECT OPEN
Analog Tachometer	No	None	Analog	Input for DC (analog) tachometer

Verify that the standard inputs connected to the Drive are properly terminated and produce the desired operation. If an input does not produce the desired result, remove power from the Drive and verify the installation.

1. Apply power to the Drive.
2. Coast-to-Stop Input – With the Coast Stop input in its CLOSED position (i.e. not in a coast stop condition) measure the voltage present between terminals 7 and 8 of the regulator board terminal strip. The measured voltage should be approximately 0V DC.

   Repeat this procedure with the Coast-to-Stop input OPEN (i.e. Drive in a Coast Stop condition). The measured voltage should be 24V.

   After proper operation is verified leave the Coast-to-Stop input in its OPEN position (i.e. Coast-to-Stop the Drive).

ATTENTION: Failure to put the Drive in the Coast-to-Stop condition could allow the Drive to restart when performing the following checks. Failure to observe this precaution could lead to personal injury and/or equipment damage.

3. Stop Input – Repeat step 2, measuring the voltage present between terminals 1 and 3 of the regulator terminal board. The voltage across the stop input should be 0VDC with the Stop input CLOSED (Stop *Not* initiated), and 24VDC with the stop input OPEN (stop initiated).
4. Customer Interlock Input – The customer interlock input is a permissive required to operate the Drive. It allows the Drive to be interlocked with the driven equipment for personnel or equipment safety purposes. If the Drive is stopped, it is prevented from running until this input is CLOSED. If the interlock input OPENS when the Drive is running, the AC contactor will be forced open, and the motor will coast to a stop.

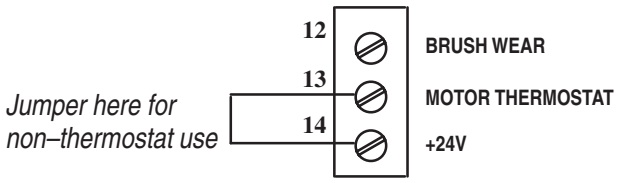
   NOTE: If the application does not require a customer interlock, verify the terminals 11 and 9 of the regulator board terminal strip are jumpered, and proceed to Step 5.

   Verify that the Customer interlock is operating properly by repeating Step 2, measuring the voltage present between terminals 11 and 9 of the regulator board terminal strip. The voltage across the stop input should be 0V DC with the Customer Interlock input CLOSED (permissive OK, and 24V DC with the stop input OPEN (permissive lost).

5. Motor Thermostat Input – If your DC Motor is equipped with a thermostat verify that it is correctly wired. Remove power from the Drive and verify that no voltage exists between either motor thermostat input terminal and ground by measuring between both terminal 13 and 14 and the Drive chassis. If voltage exists, verify motor thermostat wiring at the motor.

NOTE: If the DC motor used for this application doesn't possess a motor thermostat, verify that terminals 13 and 14 of the regulator board terminal strip are jumpered (Figure 4.11) and proceed to Step 6.

Figure 4.11
No-Thermostat Option



Regulator Board Terminal Strip
24VDC Thermostat Circuit

ATTENTION: It is strongly recommended that a motor thermostat be used to protect the motor from overheating. Failure to use a thermostat or wire it properly could result in motor failure if the motor is run at excessive load for prolonged periods.

Temporarily remove the wire terminated at thermostat input terminal 14 of the regulator board terminal strip. With an ohm meter, measure the resistance between terminal 13 and the lead removed from terminal 14. If the measured resistance isn't between 0 and 2 ohms, verify the motor thermostat wiring at the motor.

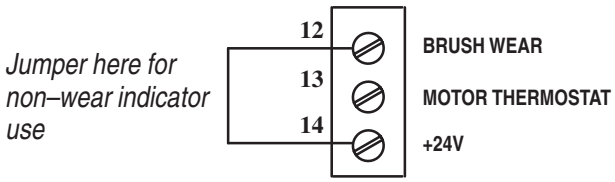
At the motor, temporarily remove one of the motor thermostat connections and perform the resistance measurement performed above. If a very high resistance is not measured (i.e. infinity, "OL", etc.) verify the motor thermostat wiring.

If resistance measurements are correct, reconnect the thermostat wiring at both the Motor and Drive.

6. Brush Wear Input – Some DC Motors are equipped with a brush wear switch which is designed to open when the carbon brushes become excessively worn. The brush wear switch is an alarm signal indicating brush wear maintenance is required.

NOTE: If the DC motor used for this application doesn't possess a brush wear indicator, verify that terminals 12 and 14 of the regulator board terminal strip are jumpered (Figure 4.12).

Figure 4.12
Brush Wear Option



Regulator Board Terminal Strip
24VDC Brush Wear Circuit

7. Other Standard Inputs – Other I/O may or may not be wired to the Drive, depending on the application. The Drive may be operated through the Human Interface Module (HIM) without connecting the remaining I/O. Other inputs may be verified as described in the preceding steps.

NOTE: If the Drive will be operated using a SCANport device such as the Bulletin 1203-GD1/GK1, 1203-GD2/GK2, 1203-GK5, 1203-FB1 & FM1, or 1203 SM1 additional set–up is required. See the chapter entitled Programming Parameters and the installation manual of the specific SCANport device.

Motor and Feedback Polarity Checks

ATTENTION: Prior to running polarity checks, you must provide a hard wired maintained external operator accessible coast/stop pushbutton at regulator board terminals 7 and 8 to disable the machine in case of improper operation. Uncontrolled machine operation can result if this is not done. Failure to observe this precaution could result in severe bodily injury or loss of life.

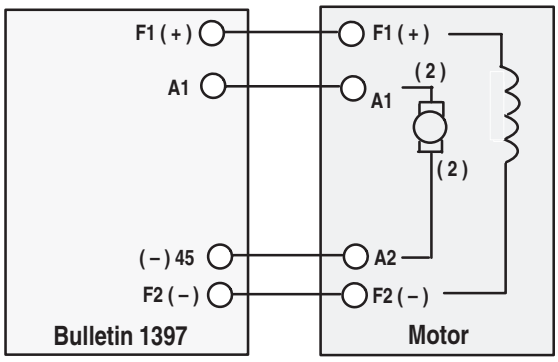
ATTENTION: If encoder/tachometer wiring is incorrect, sudden and rapid acceleration may result, which can cause overspeed of the motor. Run tach & encoder checks as detailed on pages 4-33 & 4-34. Failure to observe this precaution could result in personal injury and/or damage to equipment.

The following parameters MUST be TEMPORARILY lowered to 25% nominal to help guard against motor or equipment damage when running the following motor polarity checks:

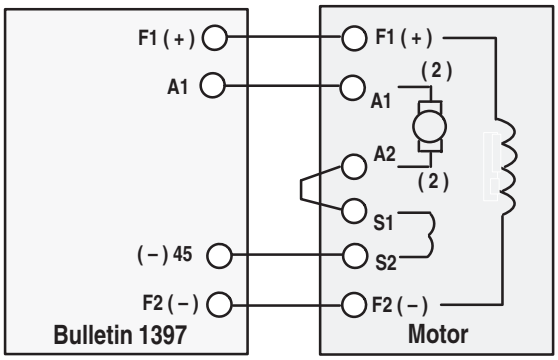
Parameter	Group	Recommended Start–Up Value
Max Process Speed (P. 042)	Setup	25% of Max Motor Speed
Positive Current Limit (P. 067)	Adv Setup	25%
Positive Current Limit Source (P. 069)	Adv Setup	Register
Negative Current Limit (P. 068)	Adv Setup	25%
Negative Current Limit Source (P.070)	Adv Setup	Register

1. Turn off and lock out all power to the Drive.
2. When checking motor polarity, the Drive will have power applied and the motor will rotate. The motor should be temporarily uncoupled from the load.
3. If the motor cannot be uncoupled from the load, the following motor checks are recommended:
   a) All electrical connections are tight.
   b) The brushes are properly seated.
   c) The motor shaft is free to rotate.
4. Connect a DC Voltmeter to Terminal A1 (+) and 45 (–) at the output of the Drive.
5. Apply power to the Drive.
6. Rotate the motor in the direction required by the driven equipment using an externally applied mechanical force.
7. Measure the voltage present between terminals A1 (+) and 45 (–). Set the meter to the 500 VDC range to start, and then work down until a measurement can be obtained. The voltage at A1 should be positive with respect to terminal 45 (voltage magnitude is unimportant).
8. If the voltage polarity is incorrect, remove power from the Drive and refer to the motor connection diagrams in Figures 4.13 & 4.14.

Figure 4.13
DC Motor Connections CCW Rotation

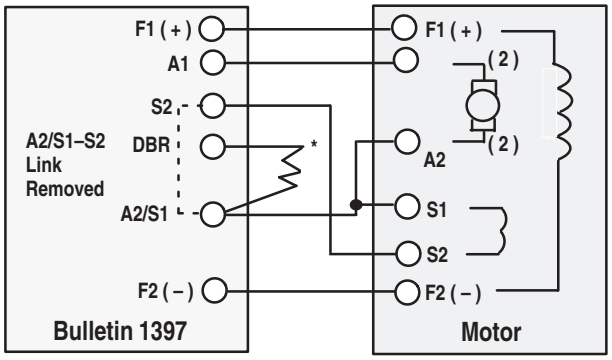


Straight Shunt Machine,
CCW Rotation, Facing Commutator End



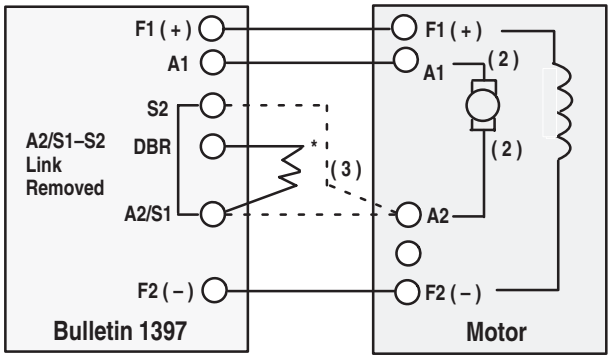
Basic Stabilized Shunt Machine,
CCW Rotation, Facing Commutator End

1.5 to 150 HP @ 230VAC
3 to 300 HP @ 460VAC



* If Used

Basic Stabilized Shunt Machine,
CCW Rotation, Facing Commutator End



* If Used

Straight Shunt Machine,
CCW Rotation, Facing Commutator End

400 to 600 HP @ 460VAC

2 – If this connection of the motor armature leads results in motor rotation opposite of what is required, reverse the A1 and A2 lead connections at the motor.
3 – Connect Drive Terminal A2/S1 or S2 to Motor Terminal A2.

9. Make certain power is turned off and locked out.

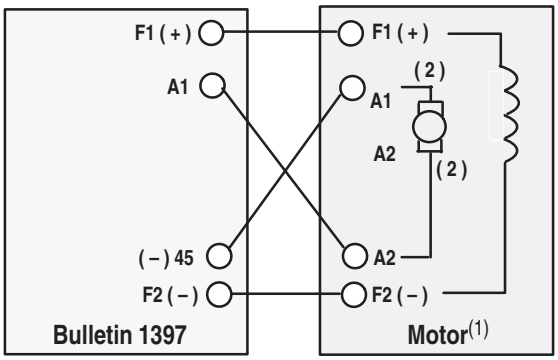
10. Switch armature leads connected A1 (+) and 45 (–). If it is inconvenient to switch the armature leads, the field leads connected at F1 and F2 may be switched instead *on a straight shunt motor only.* Be sure to document the final connection.

11. Apply power to the Drive.

12. Repeat steps 6 and 7 and verify that the motor rotation is correct.

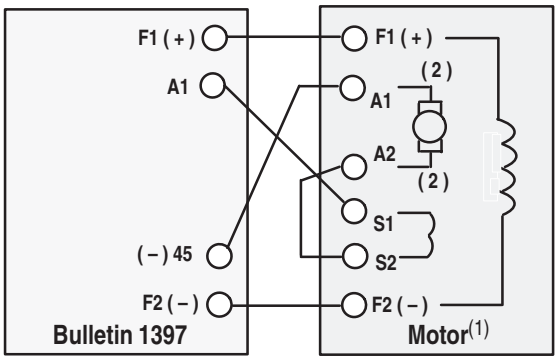
NOTE: If both the field and armature connections are reversed no change in rotation direction will occur.

Figure 4.14
Clockwise (CW) Rotation



Straight Shunt Machine,
CW Rotation, Facing Commutator End

Clockwise (CW) Rotation w/ Stab Shunt Motor



Basic Stabilized Shunt Machine,
CW Rotation, Facing Commutator End

No Feedback Device Installed (Armature Voltage Control)

1. Verify that **[Feedback Type]** (P. 039) is set to **Arm Volt** for armature voltage control.
2. Proceed to Verification of Drive Calibration sequence.

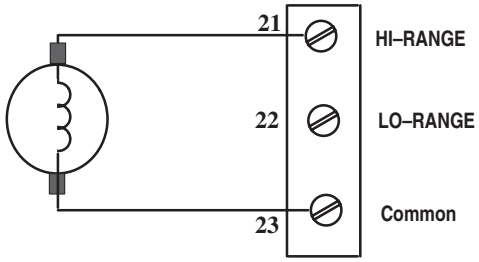
Analog Tachometer Polarity Checks (Armature Voltage Control)

ATTENTION: Prior to running polarity checks, you must provide a hardwired maintained external operator accessible coast/stop pushbutton at regulator board terminals 7 and 8 to disable the machine in case of improper operation. Uncontrolled machine operation can result if this is not done. Failure to observe this precaution could result in severe bodily injury or loss of life.

1. Verify that **[Feedback Type]** (P. 039) is set to **DC Tach**.
2. Verify that the tach is properly terminated by monitoring **[Anlg Tach Fdbk]** (P. 194) when the motor is rotated in the same direction as it was in Step 6 of the Motor and Feedback Polarity checks.
3. The value in **[Anlg Tach Fdbk]** (P. 194) should be positive.
4. If the value observed is negative, remove power from the Drive and reverse the tachometer connections terminated at the Drive. DC tachometers are terminated at terminals 21 and 23 (high voltage range) or 22 and 23 (low voltage range) of the regulator terminal strip (Figure 4.15).

ATTENTION: The Drive can overspeed if jumper J14 is set incorrectly, or the tach is wired incorrectly. Failure to observe this precaution could result in damage to the drive or process equipment.

Figure 4.15
DC Tach Installation



Regulator Board Terminal Strip
High Voltage DC Tach Terminations

5. Proceed to verification of Drive Calibration.

Pulse Encoder Polarity Checks (Regenerative Drives Only)

ATTENTION: Prior to running polarity checks, you must provide a hardwired maintained external operator accessible coast/stop pushbutton at regulator board terminals 7 and 8 to disable the machine in case of improper operation. Uncontrolled machine operation can result if this is not done. Failure to observe this precaution could result in severe bodily injury or loss of life.

1. Verify that **[Feedback Type]** (P. 039) is set to **Pulse Tach** for pulse tachometer (encoder).
2. Verify that the pulse encoder is properly terminated by monitoring **[Encoder Fdbk]** (P. 189) when the motor is rotated in the same direction as it was in Step 6 of the Motor and Feedback Polarity checks.
3. The value in **[Encoder Fdbk]** (P. 189) should be positive (magnitude is unimportant).
4. If the value observed is negative, remove power from the Drive and reverse the pulse encoder connections terminated at the pulse encoder interface board. This interface board is located behind the regulator board, inside the regulator carrier.

   Reverse the polarity of only one channel, i.e B and B NOT located at terminals 75 and 76 of the pulse encoder interface board.
5. Proceed to Verification of Drive Calibration.

Autotuning

The 1397 utilizes digital speed regulator and a digital current regulator to control the DC motor. These regulators (or "loops") may be automatically tuned by setting the appropriate tuning parameter and running the Drive when coupled to the machine (load).

ATTENTION: The motor will rotate during auto-tuning. Stay clear of rotating machinery to avoid contact with rotating parts. Failure to observe this precaution could result in bodily injury.

ATTENTION: Before starting auto-tuning, it must be verified that no overhauling or hanging loads are on the motor. Auto-tuning will not operate properly if this type of load exists. Failure to observe this precaution could result in bodily injury.

ATTENTION: Auto-tuning must not be performed on drives with motors that are mechanically coupled to one another through the process material. However, the Drive can be auto-tuned with load applied and with inertia connected. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

ATTENTION: Auto-tuning will not operate properly if prior adjustments in Chapter 4 are not performed. Perform all prior adjustment procedures contained in Chapter 4 before proceeding. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

IMPORTANT: **Speed loop autotuning** can only be performed on Drives with either pulse encoder feedback or analog tachometer feedback.

Current loop autotuning can be performed on Drives with encoder feedback, analog tach feedback or which are armature voltage controlled. This can also be performed if the Drive is configured as a current regulator (J15 = Current).

ATTENTION: Current loop tuning applies power to the motor armature and will rotate any coupled process or load. Potentially fatal voltages may be present at this time and danger of personal injury and/or equipment damage may exist due to rotation of the coupled equipment.

Autotune Set–Up

Speed loop auto tuning will tune the Drive speed regulator based on values contained in the following parameters:

[Auto Tune Bridge] (P. 112) – Determines which bridge will be used during the auto tune process. If this parameter is set to Reverse, the reverse bridge is used, and the motor runs in the reverse direction during the auto tune process. For non–regenerative Drives, this is automatically set to Forward, and cannot be changed. For most applications, satisfactory results are obtained when [Auto Tune Bridge] is set to forward.

[Auto Tune Fld Rng] (P. 113) – Scales the auto tune results based on the speed range that the Drive will operate when running the process. The value of this parameter is the ratio of [Max Motor Speed] to the motor's base speed. For example, if the motor base speed is 1750 RPM and [Max Motor Speed] is 2100 RPM, [Auto Tune Fld Rng] should be set to 1.2. (i.e. 2100 RPM / 1750 RPM = 1,2). For applications where the motor runs less than 10% above base speed, satisfactory results are obtained when [Auto Tune Fld Rng] is set to a default of 1.00.

[Auto Tune Stablty] (P. 114) – Provides a simple means for the user to adjust the performance of the speed loop without adjusting the individual gains. The default value of 25 produces a speed loop response which is satisfactory for most applications. If the user desires a faster response, a value *less than 25* may be used. If the user desires a slower speed loop response (i.e. more stability), a value *greater than 25* may be used.

IMPORTANT: Prior to performing the autotune, the application parameters whose values were previously lowered [**Max Process Speed**] (P. 042), [**Negative Current Lim**] (P. 068), [**Pos Cur Lim Src**] (P. 069), [**Pos Cur Lim**] (P. 067), must be programmed for their final value. Record the final values in Table 4.K.

Table 4.K
Application Parameters

Parameter Name	Par No.	Default	Description	Final Setting
[Max Process Spd] ***Setup Group***	**P.042**	500 RPM	The maximum speed of the drive that can be supported by the application or process.	
[Pos Current Lim] ***Adv Setup Group***	**P.067**	150% FLA	Selects the highest amount of current (% motor rated armature amps) for the forward bridge. This parameter is also a high limit for the speed loop PI block output.	
[Neg Current Lim] ***Adv Setup Group***	**P.068**	150% FLA	This parameter is only set for regenerative Drives. For non-regenerative Drives, it is automatically set to zero and cannot be changed. This input is also clamped to zero if **[Feedback Type]** is set to AC Tach or if **[Feedback Type]** is set to Pulse Tach and **[Encoder Quad]** is Off. **[Neg Current Lim]** selects the highest amount of current (% motor rated armature amps) for the reverse bridge.This parameter is also used as a low limit for the Speed Loop PI block output.	
[Pos Current Lim Src] ***Adv Setup Group***	**P.069**	0	This parameter selects the source for the positive current limit. If register is selected, the reference is [Pos Current Limit]	

Autotune Execution

The speed loop and the current loop may be tuned in one step, or each loop may be selected and tuned individually.

To execute Autotune make certain the previously lowered parameters are set to their final value,then perform the following steps:

1. Set [**Autotune Type**] (P. 052), in the setup memory to the desired tuning mode. The available selections are: “Current Loop” or “Speed Loop” or “Current and Spd”.
   Note: If tuning the Speed Loop separately, the Current Loop should have been previously tuned for best results.
2. Press START
   Note: Current Loop tunes in approximately 3 to 4 seconds
   Speed Loop tunes in approximately 1 minute.

If no faults occur, the Drive stops with tuned values in memory. In order to save these values the user must perform a memory save in the EEPROM menu so that these values are not lost if power is cycled. The Run key is now back to normal operation.

Save Parameters to EEPROM –
IMPORTANT – Upon competition of the auto tune procedure, the parameters must be written to the non–volatile EEPROM memory, or they will be lost when power is removed from the Drive.

NOTE: For applications requiring precise speed control, the speed regulator may require manual tuning to achieve the desired response. Manual adjustment of KP and KI velocity loops may be necessary in some applications. Consult the factory for assistance if tuning KP/KI loops becomes necessary

Application Set–Up

There are several parameters associated with the use of the 1397 Drive for specific applications. At this point, the basic Drive control has been tuned for simple speed control. If it is desired to operate the Drive using one of the optional functions, refer to Chapter 5 for a description of the parameters associated with these functions. In addition to set up of the Drive parameters associated with these functions, it is also necessary to verify correct configuration of the Source to Sink Parameters for the external control device being used to control the Drive for the specific application. Refer to the appropriate adapter board instruction manual for a description of how to use the adapter board and how to interface the adapter board to the Drive when various Drive functions are desired.

Programming Parameters

Introduction

This chapter contains the information required to assist the user in programming the Drive for a specific application after initial start-up. Drives are shipped programmed with default values and are preconfigured for the factory installed options.

The Drive parameters are divided into the following categories:
Diagnostics – These parameters provide information on various test, status and alarm inputs.
Masks – These parameters contain binary masks for all control functions. The masks control which adapters can issue control commands.
Owners – These parameters contain binary information to display which group of adapters is issuing control command.
Adapter I/O – Input and Output parameters for the optional communication adapter board used with the 1397.
Process Display – These parameters provide input to the Human Interface Module programming device.
Field – These parameters allow you to alter Field Supply levels, delays, current references, gain, etc.
Process PI – Status & Reference parameters for the Outer Control Loop.
Metering – These parameters allow you to monitor various reference sources such as Analog Inputs, Speed Loops, Current Loops, Ramp Input and Outputs etc.
Setup – These parameters define basic operation and require configuration during the Start-Up procedure.
Advanced Setup – These parameters require configuration during Start-Up when selected options are used, or with advanced and complex applications.
Reference Set – These parameters allow you to select options such as Accel/Decel times, Preset speeds, Jog times etc.
Feature Select – This parameter group contains the necessary parameters to activate and program advanced features of the Drive.
Input Configuration – These parameters accept analog information from sources outside the Drive.
Output Configuration – These parameters provide analog & digital output information.

Record Keeping

Record any changes made to the parameters for future reference during troubleshooting or tuning. A User Parameter value chart is supplied in Appendix D.

Safety Precautions

ATTENTION: Hazards of bodily injury or equipment damage are associated with many parameter settings. You must read and observe specific precautions before changing any parameter. Contact Rockwell Automation for assistance if you do not understand the hazard.

Parameter Groups

METERING

1–Anlg In 1 (pg. 5–14)
2–Anlg In 2 (pg. 5–14)
3–Anlg In 3 (pg. 5–14)
4–Anlg In 4 (pg. 5–15)
5–Arm Volt (pg. 5–15)
6–Cur Loop Fdbk (pg. 5–15)
7–Cur Loop Error (pg. 5–15)
8–Cur Loop Ref (pg. 5–16)
9–Draw Percent Out (pg. 5–16)
10–Field Feedback (pg. 5–16)
11–Frequency In (pg. 5–16)
12–Jog Ramp Output (pg. 5–17)
13–Monitor 1 Output (pg. 5–17)
14–Monitor 2 Output (pg.5–17)
15–MOP Output (pg. 5–17)
16–OCL Enable TP (pg. 5–18)
17–OCL Feedback (pg. 5–18)
18–OCL Output (pg. 5–18)
19–OCL Ramp Output (pg. 5–18)
20–OCL Reference TP (pg. 5–18)
21–Spd Loop Error (pg. 5–19)
22–Spd Loop Fdbk (pg. 5–19)
23–Spd Loop Lag Out (pg. 5–19)
24–Spd Loop Output (pg. 5–19)
25–Spd Loop Ref (pg. 5–20)
26–Spd Src Output (pg. 5–20)
27–Spd Ramp In TP (pg. 5–20)
28–Spd Ramp Output (pg. 5–20)
29–Speed Pot (pg. 5–21)
30–Trim Output (pg. 5–21)
31–Torque Reference (pg. 5–21)

TP = Test Point

SETUP

36–CT Turns Ratio (pg. 5–22)
37–Accel Time (pg. 5–22)
38–Decel Time (pg. 5–23)
39–Feedback Type (pg. 5–23)
40–Maximum Current (pg. 5–23)
41–Max Motor Speed (pg. 5–23)
42–Max Process Spd (pg. 5–24)
43–Min Process Spd (pg. 5–24)
44–Motor Field Amps (pg. 5–25)
45–Motor Arm Amps (pg. 5–25)
46–Motor Arm Volts (pg. 5–26)
47–AnlgTach v/1000 (pg. 5–26)
48–Encoder PPR (pg. 5–26)
49–Encoder Quad (pg. 5–27)
50–Nominal AC Freq (pg. 5–27)
51–Nominal AC Volts (pg. 5–27)
52–Autotune Type (pg. 5–27)

ADV SETUP

57–Anlg Tach Gain (pg. 5–28)
58–Anlg Tach Zero (pg. 5–28)
59–Arm Voltage Gain (pg. 5–28)
60–Arm Voltage Zero (pg. 5–29)
61–Cur Loop K–Fdbk (pg. 5–29)
62–Cur Lp Lead Freq (pg. 5–29)
63–Cur Loop Kp (pg. 5–29)
64–Cur Loop RateLim (pg.5–30)
66–IR Compensation (pg. 5–30)
67–Pos Current Lim (pg. 5–30)
68–Neg Current Lim (pg. 5–30)
69–Pos Cur Lim Src (pg. 5–31)
70–Neg Cur Lim Src (pg. 5–31)
71–PLL Max Error (pg. 5–32)
72–Spd LeadLag Freq (pg. 5–32)
73–Spd LeadLag Rato (pg. 5–32)
74–Spd LeadLag Type (pg. 5–32)
75–Spd Lp Lag Freq (pg. 5–33)
76–Spd Lp Lag Type (pg. 5–33)
77–Spd Lp Lead Freq (pg. 5–33)
78–Spd Loop Kp (pg. 5–33)
79–Tach Loss Angle (pg. 5–33)

Parameter Groups

REFERENCE SET

84–MOP Accel Time (pg. 5–34)
85–MOP Decel Time (pg. 5–34)
86–MOP Reset Enable (pg. 5–34)
87–Preset Speed 1 (pg. 5–35)
88–Preset Speed 2 (pg. 5–35)
89–Preset Speed 3 (pg. 5–35)
90–Ref 1 Source (pg. 5–35)
91–Ref 2 Source (pg. 5–36)
92–Jog Acc/Dec Time (pg. 5–36)
93–Jog Reference (pg. 5–36)
94–Jog Off Dly Time (pg. 5–37)

FEATURE SELECT

99–Min Speed Bypass (pg. 5–38)
100–Ref Ramp Bypass (pg. 5–38)
101–Current Compound (pg. 5–38)
102–Inertia Comp Src (pg. 5–39)
103–Monitor 1 Delay (pg. 5–39)
104–Monitor 1 Source (pg. 5–40)
105–Monitor 1 Level (pg. 5–40)
106–Monitor 2 Delay (pg. 5–41)
107–Monitor 2 Source (pg. 5–41)
108–Monitor 2 Level (pg. 5–42)
109–Normal Inertia (pg. 5–42)
110–Reverse Disable (pg. 5–42)
111–S–Curve Rounding (pg. 5–43)
112–AutoTune Bridge (pg. 5–43)
113–AutoTune Fld Rng (pg. 5–44)
114–AutoTune Stablty (pg. 5–44)
115–Stop Mode Type (pg. 5–44)
116–Stop Speed Level (pg. 5–44)
117–Trim Mode Type (pg. 5–45)
118–Trim Range (pg. 5–45)
119–Trim Ref Source (pg. 5–45)
120–Trim Reference (pg. 5–46)
121–OCL Enable Src (pg. 5–46)
122–Inertia Comp Reg (pg. 5–46)

INPUT CONFIG

127–Anlg In 1 Gain (pg. 5–47)
128–Anlg In 1 Type (pg. 5–47)
129–Anlg In 1 Zero (pg. 5–47)
130–Anlg In 2 Gain (pg. 5–47)
131–Anlg In 2 Zero (pg. 5–48)
132–Anlg In 3 Gain (pg. 5–48)
133–Anlg In 3 Type (pg. 5–48)
134–Anlg In 3 Zero (pg. 5–49)
135–Anlg In 4 Gain (pg. 5–49)
136–Anlg In 4 Zero (pg. 5–49)
137–Freq In Scale (pg. 5–49)
138–Freq In Zero (pg. 5–50)

OUTPUT CONFIG

144–Anlg Out 1 Gain (pg. 5–51)
145–Anlg Out 1 Src (pg. 5–52)
146–Anlg Out 1 Zero (pg. 5–53)
147–Anlg Out 2 Gain (pg. 5–53)
148–Anlg Out 2 Src (pg. 5–54)
149–Anlg Out 2 Zero (pg. 5–55)
150–Anlg Out 3 Gain (pg. 5–55)
151–Anlg Out 3 Src (pg. 5–56)
152–Anlg Out 3 Type (pg. 5–57)
153–Anlg Out 4 Gain (pg. 5–57)
154–Anlg Out 4 Src (pg. 5–58)
155–Dig Out 1 Src (pg. 5–59)
156–Dig Out 1 Type (pg. 5–59)
157–Dig Out 2 Src (pg. 5–60)
158–Dig Out 2 Type (pg. 5–60)
159–Freq Out Scale (pg. 5–60)
160–Freq Out Source (pg. 5–61)
161–Freq Out Zero (pg. 5–62)

DIAGNOSTICS

167–Open SCR Sens (pg. 5–63)
168–Open SCR Trip Pt (pg. 5–63)
169–Ph Tst Delta (pg. 5–63)
170–Ph Tst Bridge (pg. 5–63)
171–Armature Bridge (pg. 5–64)
172–Armature Delta (pg. 5–64))
173–Cur Compound TP (pg. 5–64)
174–Field Delta (pg. 5–64)
175–Field Econ Active (pg. 5–65)
176–Field Ref TP (pg. 5–65)
177–Field Regulator (pg. 5–65)
178–Expansion I/O (pg. 5–65)
179–IR Comp TP (pg. 5–66)
180–J11 Tach V Scale (pg. 5–66)
181–J14 Tach V Range (pg. 5–66)
182–J15 Reg Type (pg. 5–66)
183–J18 Arm Fdbk Res (pg. 5–67)
184–J20 Fld Loss Det (pg. 5–67)
185–J21 Field Supply (pg. 5–67)
186–Power Unit Type (pg. 5–68)
187–Encoder Kit (pg. 5–68)
188–Regulator SW Ver (pg. 5–68)
189–Encoder Fdbk (pg. 5–68)
190–Logic Status (pg. 5–69)
191–Drive Status (pg. 5–69)
192–AC Line Period (pg. 5–70)
193–AC Line Voltage (pg. 5–70)
194–Anlg Tach Fdbk (pg. 5–70)
195–Exp I/O Dig In (pg. 5–70)
196–Fault Reset (pg. 5–71)
197–Alarm Reset (pg. 5–71)
198–CPU Loading (pg. 5–71)
200–SCANport Errors (pg. 5–71)

MASKS

201–Start Mask (pg. 5–72)
202–Direction Mask (pg. 5–72)
203–Jog Mask (pg. 5–72)
204–Reference Mask (pg. 5–73)
205–Fault Reset Mask (pg. 5–73)
206–MOP Mask (pg. 5–73)
207–Logic Mask (pg. 5–74)
208–Local Mask (pg. 5–74)

OWNERS

214–Stop Owner (pg. 5–75)
215–Run Owner (pg.5–75)
216–Direction Owner (pg. 5–75)
217–Jog Owner (pg. 5–76)
228–Reference Owner (pg. 5–76)
219–Flt Reset Owner (pg. 5–77)
220–MOP Owner (pg. 5–77)
221–Local Owner (pg. 5–77)

Adapter I/O

226–Data In A1 (pg. 5–78)
227–Data In A2 (pg. 5–78)
228–Data In B1 (pg. 5–78)
229–Data In B2 (pg. 5–78)
230–Data In C1 (pg. 5–79)
231–Data In C2 (pg. 5–79)
232–Data In D1 (pg. 5–79)
233–Data In D2 (pg. 5–79)
234–Data Out A1 (pg. 5–80)
235–Data Out A2 (pg. 5–80)
236–Data Out B1 (pg. 5–80)
237–Data Out B2 (pg. 5–80)
238–Data Out C1 (pg. 5–81)
239–Data Out C2 (pg. 5–81)
240–Data Out D1 (pg. 5–81)
241–Data Out D2 (pg. 5–81)

Process Display

247–Process 1 Par (pg. 5–82)
248–Process 1 Scale (pg. 5–82)
249–Process 1 Text 1 (pg. 5–82)
250–Process 1 Text 2 (pg. 5–82)
251–Process 1 Text 3 (pg. 5–83)
252–Process 1 Text 4 (pg. 5–83)
253–Process 1 Text 5 (pg. 5–83)
254–Process 1 Text 6 (pg. 5–83)
255–Process 1 Text 7 (pg. 5–84)
256–Process 1 Text 8 (pg. 5–84)
257–Process 2 Par (pg. 5–84)
258–Process 2 Scale (pg. 5–84)
259–Process 2 Text 1 (pg. 5–85)
260–Process 2 Text 2 (pg. 5–85)
261–Process 2 Text 3 (pg. 5–85)
262–Process 2 Text 4 (pg. 5–85)
263–Process 2 Text 5 (pg. 5–86)
264–Process 2 Text 6 (pg. 5–86)
265–Process 2 Text 7 (pg. 5–86)
266–Process 2 Text 8 (pg. 5–86)

Field

272–E – Fld Volts Adj (pg. 5–87)
273–Fld Econ Delay (pg. 5–87)
274–Fld Econ Ref (pg. 5–87)
275–Fld Auto Weak (pg. 5–88)
276–Fld Delta Hi Lim (pg. 5–88)
277–Fld Loss Level (pg. 5–89)
278–Fld Lp Lead Freq (pg. 5.89)
279–Fld Loop Kp (pg. 5–89)
280–Field Reference (pg. 5–90)
281–Fld Loop K–Fdbk (pg. 5–90)
282–Fld Weak Ld Freq (pg. 5–90)
283–Fld Weaken Kp (pg. 5–90)
284–Fld Weaken Level (pg. 5–90)

Process PI

290–OCL Fdbk Source (pg. 5–91)
291–OCL LeadLag Freq (pg. 5–91)
292–OCL LeadLag Rato (pg. 5–92)
293–OCL LeadLag Type (pg. 5–92)
294–OCL Kp (pg. 5–92)
295–OCL Lead Freq (pg. 5–93)
296–OCL Pos Limit (pg. 5–93)
297–OCL Neg Limit (pg. 5–93)
298–OCL Ramp Time (pg. 5–94)
299–OCL Reference (pg. 5–94)
300–OCL Ref Rounding (pg. 5–95)
301–OCL Ref Source (pg. 5–95)
302–OCL Trim Range (pg. 5–96)
303–OCL Enable (pg. 5–96)
304–OCL Fdbk Reg (pg. 5–96)

Numeric Parameter Table

Table 5.A
1397 Parameters

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
1	Anlg In 1	RPM	–5369	5369	0		Metering
2	Anlg In 2	RPM	–5369	5369	0		Metering
3	Anlg In 3	Counts	–5369	5369	0		Metering
4	Anlg In 4	Counts	–5369	5369	0		Metering
5	Armature Voltage	Volts	–675	675	0		Metering
6	Cur Loop Fdbk	Amps	–2400	2400	0		Metering
7	Cur Loop Error	Amps	–3840	3840	0		Metering
8	Cur Loop Ref	Amps	–4440	1440	0		Metering
9	Draw Percent Out	%	+/– 0.10	+/–100.0	0		Metering
10	Field Feedback	Amps	–0.0	20.0	0		Metering
11	Frequency In	KHZ	–2000	2000	0		Metering
12	Jog Ramp Output	RPM	–5000	5000	0		Metering
13	Monitor 1 Output		0 (OFF)	1 (ON)	0		Metering
14	Monitor 2 Output		0 (OFF)	1 (ON)	0		Metering
15	MOP Output	RPM	–5000	5000	0		Metering
16	OCL Enable TP		0 (Disabled)	1 (Enable)	0		Metering
17	OCL Feedback	CNTS	–5120	5120	0		Metering
18	OCL Output	RPM	–5000	5000	0		Metering
19	OCL Ramp Output	CNTS	–4095	4095	0		Metering
20	OCL Reference TP	CNTS	–4095	4095	0		Metering
21	Spd Loop Error	RPM	–8190	8190	0		Metering
22	Spd Loop Fdbk	RPM	–4095	4095	0		Metering
23	Spd Loop Lag Out	RPM	–4095	4095	0		Metering
24	Spd Loop Output	AMPS	–1440	1440	0.00		Metering
25	Spd Loop Ref	RPM	–5000	5000	0		Metering
26	Spd Src Output	RPM	–5000	5000	0		Metering
27	Spd Ramp In TP	RPM	–5000	5000	0		Metering
28	Spd Ramp Output	RPM	–5000	5000	0		Metering
29	Speed Pot	RPM	–5000	5000	0		Metering
30	Trim Output	RPM	–5000	5000	0		Metering
31	Torque Reference	AMPS	–960	960	0		Metering
32	METERING 1	*(Hidden)*	*FUTURE*	*USE*			Metering
33	METERING 2	*(Hidden)*	*FUTURE*	*USE*			Metering
34	METERING 3	*(Hidden)*	*FUTURE*	*USE*			Metering
35	METERING 4	*(Hidden)*	*FUTURE*	*USE*			Metering
36	CT Turns Ratio	TP/TN	1	32767	NA	Configurable	Setup
37	Accel Time	Seconds	0.1	300	5.0	Tunable	Setup
38	Decel Time	Seconds	0.1	300	5.0	Tunable	Setup

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
39	Feedback Type	Selection	(0) Arm Volt	(3)AC Tach	(0) Arm Volt	Configurable	Setup
40	Maximum Current	FLA	25%	200%	150%	Tunable	Setup
41	Max Motor Speed	RPM	5	5000	500	Configurable	Setup
42	Max Process Speed	RPM	1	User Defined	500	Tunable	Setup
43	Min Process Speed	RPM	0	User Defined	250	Tunable	Setup
44	Motor Field Amps	AMPS	0.11	ISR	0.01	Configurable	Setup
45	Motor Arm Amps	AMPS	0.1	3000	8	Configurable	Setup
46	Motor Arm Volts	VOLTS	160	675	240	Configurable	Setup
47	Anlg Tach V/100	Volts per RPM	18.0v	200.v	18.0v	Configurable	Setup
48	Encoder PPR	PPR	18	2500	18	Configurable	Setup
49	Encoder Quad	Selection	1 (On)	0 (Off)	1 (On)	Configurable	Setup
50	Nominal AC Freq	Hz	48Hz	62 HZ	50 or 60Hz	Configurable	Adv Setup
51	Nominal AC Volts	VAC	200V	575V	230VAC	Configurable	Adv Setup
52	Auto Tune Type		*0*	3	0	Configurable	Setup
53	SETUP 2	*(Hidden)*	*FUTURE*	*USE*			Setup
54	SETUP 3	*(Hidden)*	*FUTURE*	*USE*			Setup
55	SETUP 4	*(Hidden)*	*FUTURE*	*USE*			Setup
56	SETUP 5	*(Hidden)*	*FUTURE*	*USE*			Setup
57	Anlg Tach Gain		0.750	1.250	1.000	Tunable	Adv Setup
58	Anlg Tach Zero		–200	200	0	Tunable	Adv Setup
59	Arm Voltage Gain		0.750	1.250	1.000	Tunable	Adv Setup
60	Arm Voltage Zero		–200	200	0	Tunable	Adv Setup
61	Cur Loop K–Fdbk		1.000	1.100	1.000	Tunable	Adv Setup
62	Cur Lp Lead Freq	rad/sec	10	500	100	Tunable	Adv Setup
63	Cur Loop Kp		0.000	4.000	0.250	Tunable	Adv Setup
64	Cur Loop Rate Lim	ms	1	100	40	Tunable	Adv Setup
65	METERING 5	*(Hidden)*	*FUTURE*	*USE*			Adv Setup
66	IR Compensation	%FLA	0%	50%	0%	Tunable	Adv Setup
67	Pos Cur Lim	%FLA	0	150%	150%	Tunable	Adv Setup
68	Neg Cur Lim	%FLA	0	150%	150%	Tunable	Adv Setup
69	Pos Cur Lim Src	ENUM	0	9	0(Register)	Configurable	Adv Setup
70	Neg Cur Lim Src	ENUM	0	9	0(Register)	Configurable	Adv Setup
71	PLL Max Error	uSEC	2	1000	1.00	Tunable	Adv Setup
72	Spd Lead Lag Freq	rad/sec	1	3490	100	Tunable	Adv Setup
73	Spd Lead Lag Rato	ratio	2	20	2	Tunable	Adv Setup
74	Spd Lead Lag Type	selection	0 (Lead/Lg)	2(Lag/Lead)	1(Bypass)	Tunable	Adv Setup
75	Spd Lp Lag Freq	rad/sec	0.01	69.81	1.00	Tunable	Adv Setup
76	Spd Lp Lag Type	selection	0	1	1	Tunable	Adv Setup
77	Spd Lp Lead Freq	rad/sec	0.00	141.37	3.00	Tunable	Adv Setup
78	Spd Loop Kp		0.10	128.0	4.40	Tunable	Adv Setup

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
79	ADV SETUP 1	*(Hidden)*	*FUTURE*	*USE*			Reference Set
80	ADV SETUP 2	*(Hidden)*	*FUTURE*	*USE*			Reference Set
81	ADV SETUP 3	*(Hidden)*	*FUTURE*	*USE*			Reference Set
82	ADV SETUP 4	*(Hidden)*	*FUTURE*	*USE*			Reference Set
83	ADV SETUP 5	*(Hidden)*	*FUTURE*	*USE*			Reference Set
84	MOP Accel Time	Seconds	1.0	300	0.1	Tunable	Reference Set
85	MOP Decel Time	Seconds	1.0	300	0.1	Tunable	Reference Set
86	MOP Reset Enable		0	1	0	Tunable	Reference Set
87	Preset Speed 1	RPM/%FLA	Min Pro Spd	Max Pro Spd	250	Tunable	Reference Set
88	Preset Speed 2	RPM/%FLA	Min Pro Spd	Max Pro Spd	250	Tunable	Reference Set
89	Preset Speed 3	RPM/%FLA	Min Pro Spd	Max Pro Spd	250	Tunable	Reference Set
90	Ref 1 Source	Enum	0	14	0	Tunable	Reference Set
91	Ref 2 Source	Enum	0	14	1	Tunable	Reference Set
92	Jog Acc/Dec Time	Seconds	0.10	300	3.0	Tunable	Reference Set
93	Jog Reference	RPM	0	Max Pro Spd	250	Tunable	Reference Set
94	Jog Off Dly Time	Seconds	0	10	1	Configurable	Reference Set
95	REF SETUP 2	*(Hidden)*	*FUTURE*	*USE*			Reference Set
96	REF SETUP 3	*(Hidden)*	*FUTURE*	*USE*			Reference Set
97	REF SETUP 4	*(Hidden)*	*FUTURE*	*USE*			Reference Set
98	REF SETUP 5	*(Hidden)*	*FUTURE*	*USE*			Reference Set
99	Min Speed Bypass	Numeric	0 (Off)	1 (On)	0 (Off)	Tunable	Feature Select
100	Ref Ramp Bypass	Numeric	0 (Off)	1 (On)	0 (Off)	Tunable	Feature Select
101	Current Compound	%	–50	50	0	Tunable	Feature Select
102	Inertia Comp Src	Enum	0	10	0	Tunable	Feature Select
103	Monitor 1 Delay	Seconds	0	300	1.0	Tunable	Feature Select
104	Monitor 1 Source	Selection	0	4	1	Configurable	Feature Select
105	Monitor 1 Level	%	1.0%	100%	10%	Tunable	Feature Select
106	Monitor 2 Delay	Seconds	0	30.0	1.0	Tunable	Feature Select
107	Monitor 2 Source	Selection	0	4	3	Tunable	Feature Select
108	Monitor 2 Level	%	0.1	100	10	Tunable	Feature Select
109	Normal Inertia	Seconds	0.05	65.20	1.00	Tunable	Feature Select
110	Reverse Disable		Off	1 (On)	0 (Off)	Configurable	Feature Select
111	S-Curve Rounding	%	0%	50%	0%	Tunable	Feature Select
112	AutoTune Bridge	Selection	0	1	0 (Forward)	Tunable	Feature Select
113	AutoTune Fld Rng		0.90	5.00	1.00	Tunable	Feature Select
114	AutoTune Stabilty		10	100	25	Tunable	Feature Select
115	Stop Mode Type	Selectable	0 (Ramp)	2 (Coast/DB)	2	Tunable	Feature Select
116	Stop Speed Level	RPM	0	Max Spd	50	Tunable	Feature Select
117	Trim Mode Type	Selectable	0 (No Trim)	2 (Proportion)	0 (No Trim)	Tunable	Feature Select

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
118	Trim Range	%	0.0	1000	0		Feature Select
119	Trim Ref Source	Enum	0	11	0		Feature Select
120	Trim Reference	%	–100.0	100	0		Feature Select
121	OCL ENABLE SRC	Enum	0	1	0		Feature Select
122	FEATR SEL 1	*(Hidden)*	*FUTURE*	*USE*			Feature Select
123	FEATR SEL 2	*(Hidden)*	*FUTURE*	*USE*			Feature Select
124	FEATR SEL 3	*(Hidden)*	*FUTURE*	*USE*			Feature Select
125	FEATR SEL 4	*(Hidden)*	*FUTURE*	*USE*			Feature Select
126	FEATR SEL 5	*(Hidden)*	*FUTURE*	*USE*			Feature Select
127	Anlg In 1 Gain		0.750	1.250	1.000	Tunable	Input Config
128	Anlg In 1 Type	Volts/Amps	0	3	0 (0–10V)	Configurable	Input Config
129	Anlg In 1 Zero		–200	+200	1.000	Tunable	Input Config
130	Anlg In 2 Gain		0.750	1.250	+/– 10 V	Tunable	Input Config
131	Anlg In 2 Zero		–200	+200	0	Tunable	Input Config
132	Anlg In 3 Gain		0.750	2.250	3 (10–50mA)	Tunable	Input Config
133	Anlg In 3 Type	Volts/Amps	0–10V	10–50mA	0	Configurable	Input Config
134	Anlg In 3 Zero		–200	+200	1.0	Tunable	Input Config
135	Anlg In 4 Gain		0.750	2.250	Zero	Tunable	Input Config
136	Anlg In 4 Zero		–200	+200	250	Tunable	Input Config
137	Freq In Scale	kHz	2.0	250		Configurable	Input Config
138	Freq In Zero	kHz	2.0	250		Configurable	Input Config
139	IN CFG 1	*(Hidden)*	*FUTURE*	*USE*			Input Config
140	IN CFG 2	*(Hidden)*	*FUTURE*	*USE*			Input Config
141	IN CFG 3	*(Hidden)*	*FUTURE*	*USE*			Input Config
142	IN CFG 4	*(Hidden)*	*FUTURE*	*USE*			Input Config
143	IN CFG 5	*(Hidden)*	*FUTURE*	*USE*			Input Config
144	Anlg Out 1 Gain		0.100	1.900	1.000	Tunable	Output Config
145	Anlg Out 1 Src	Selection	0	22	0	Tunable	Output Config
146	Anlg Out 1 Zero		–200	200	0	Tunable	Output Config
147	Anlg Out 2 Gain		0.100	1.900	1.000	Tunable	Output Config
148	Anlg Out 2 Src	Selection	0	22	3	Tunable	Output Config
149	Anlg Out 2 Zero		–200	200	0	Tunable	Output Config
150	Anlg Out 3 Gain	VDC	0.500	1.300	1.0	Tunable	Output Config
151	Anlg Out 3 Src	Selection	0	22	0	Configurable	Output Config
152	Anlg Out 3 Type	Selection	0 (0–10V)	3 (10–50mA)	1 (+/– 10V)	Configurable	Output Config
153	Anlg Out 4 Gain	VDC	0.500	1.300	1.000	Tunable	Output Config
154	Anlg Out 4 Src	Enum	0	22	0	Configurable	Output Config
155	Dig Out 1 Src	Enum	0	3	0	Configurable	Output Config
156	Dig Out 1 Type	Selection	0 (Open)	1 (Closed)	0 (Open)	Configurable	Output Config

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
157	Dig Out 2 Src	Enum	0	3	1	Configurable	Output Config
158	Dig Out 2 Type	Selection	0 (Open)	Closed	0 (Open)	Configurable	Output Config
159	Dig Out Scale	kHz	2.0	250.0	250.0	Configurable	Output Config
160	Freq Out Src	Enum	0	22	14	Configurable	Output Config
161	Freq Out Zero	kHz	2.0	250.0	2.0	Configurable	Output Config
162	Out CFG 1	*(Hidden)*	*FUTURE*	*USE*			Output Config
163	Out CFG 2	*(Hidden)*	*FUTURE*	*USE*			Output Config
164	Out CFG 3	*(Hidden)*	*FUTURE*	*USE*			Output Config
165	Out CFG 4	*(Hidden)*	*FUTURE*	*USE*			Output Config
166	Out CFG 5	*(Hidden)*	*FUTURE*	*USE*			Output Config
167	Open SCR Sens	%	0	0	0	Tunable	Diagnostics
168	Open SCR Trp Pt.	%	800%	4000%	800%	Tunable	Diagnostics
169	Phase Test Delta	Degrees	0	180	0	Tunable	Diagnostics
170	Phase Test Bridge	Selection	0(Forward)	1(Reverse)	0	Tunable	Diagnostics
171	Armature Bridge	Enum	0 (Forward)	1 (Reverse)	0		Diagnostics
172	Armature Delta	uSEC	–6480	6480	0		Diagnostics
173	Cur Compound TP	RPM	–4095	4095	0		Diagnostics
174	Field Delta	DEG	–5400	5400	0		Diagnostics
175	Fld Econ Active	Enum	0 (Not Active)	1 (Active)	0 (Not Active)		Diagnostics
176	Field Ref TP	Amps	–0.1	15	0.0		Diagnostics
177	Field Regulator	Enum	Not Install	20 Amp	N.A.		Diagnostics
178	Expansion I/O	Enum	0 (Not Instal)	3 (Failed)	Not Install		Diagnostics
179	IR Comp TP	Volt	0	338	0		Diagnostics
180	J11 Tach V Scale	Text	–1920	1920	0		Diagnostics
181	J14 Tach V Range	Enum	0	1	0		Diagnostics
182	J15 Reg Type	Enum	0	1	0		Diagnostics
183	J18 Arm Fdbk Res	Enum	0	4	0		Diagnostics
184	J20 Fld Loss Det	Enum	0	1	0		Diagnostics
185	J21 Fld Supply Jmp	Enum	0	1	0		Diagnostics
186	Power Unit Type	Enum	0	1	0	Drive Info	Diagnostics
187	Encoder Kit	Enum	0 (Not Install)	2 (Failed)	0 (Not Install)	Drive Info	Diagnostics
188	Regulator SW Rev	Text	1.04	1.xx	1.xx	Drive Info	Diagnostics
189	Encoder Fdbk	RPM	–4001	4001	0	Drive Info	Diagnostics
190	Logic Status	Enum	0 (Enabled)	15 (Ref ID)	0 (Enabled)	Drive Info	Diagnostics
191	Drive Status	Enum	0 (Not Ready)	6 (Faulted)	0 (Not Ready)	Drive Info	Diagnostics
192	AC Line Period	uSEC	16124	20833	0	Drive Info	Diagnostics
193	AC Line Voltage	VAC	200	575	0	Drive Info	Diagnostics
194	Anlg Tach Fdbk	RPM	-4095	4095	0	Drive Info	Diagnostics
195	Exp I/IO DIG IN	Enum	0 (Preset A)	4 (OCL En)	0 (Preset A)		Diagnostics

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
196	Fault Reset	Enum	0 (Ready)	1 (Reset)	0		Diagnostics
197	Alarm Reset	Enum	0 (Ready)	1 (Reset)	0		Diagnostics
198	CPU Loading	%					Diagnostics
199	*Not Used*		0	31	0		Diagnostics
200	ScanPort Errors		0	6500	0		Diagnostics
201	Start Mask	Enum	0	127	126	Configurable	Masks
202	Direction Mask	Enum	0	127	127	Configurable	Masks
203	Jog Mask	Enum	0	127	127	Configurable	Masks
204	Reference Mask	Enum	0	127	127	Configurable	Masks
205	Fault Reset Mask	Enum	0	127	127	Configurable	Masks
206	MOP Mask	Enum	0	127	127	Configurable	Masks
207	Logic Mask	Enum	0	127	127	Configurable	Masks
208	Local Mask	Enum	0	127	127	Configurable	Masks
209	MASKS 1	*(Hidden)*	*FUTURE*	*USE*			Masks
210	MASKS 2	*(Hidden)*	*FUTURE*	*USE*			Masks
211	MASKS 3	*(Hidden)*	*FUTURE*	*USE*			Masks
212	MASKS 4	*(Hidden)*	*FUTURE*	*USE*			Masks
213	MASKS 5	*(Hidden)*	*FUTURE*	*USE*			Masks
214	Stop Owner	Enum	0	127	0	Read Only	Owners
215	Start Owner	Enum	0	127	0	Read Only	Owners
216	Direction Owner	Enum	0	127	0	Read Only	Owners
217	Jog Owner	Enum	0	127	0	Read Only	Owners
218	Reference Owner	Enum	0	127	0	Read Only	Owners
219	Flt Reset Owner	Enum	0	127	0	Read Only	Owners
220	MOP Owner	Enum	0	127	0	Read Only	Owners
221	Local Owner	Enum	0	127	0	Read Only	Owners
222	OWNERS 2	*(Hidden)*	*FUTURE*	*USE*			Owners
223	OWNERS 3	*(Hidden)*	*FUTURE*	*USE*			Owners
224	OWNERS 4	*(Hidden)*	*FUTURE*	*USE*			Owners
225	*Not Used*						Owners
226	DATA IN A1	Param #	0	308	0	Read & Write	Adapter I/O
227	DATA IN A2	Param #	0	308	0	Read & Write	Adapter I/O
228	DATA IN B1	Param #	0	308	0	Read & Write	Adapter I/O
229	DATA IN B2	Param #	0	308	0	Read & Write	Adapter I/O
230	DATA IN C1	Param #	0	308	0	Read & Write	Adapter I/O
231	DATA IN C2	Param #	0	308	0	Read & Write	Adapter I/O
232	DATA IN D1	Param #	0	308	0	Read & Write	Adapter I/O
233	DATA IN D2	Param #	0	308	0	Read & Write	Adapter I/O
234	DATA OUT A1	Param #	0	308	0	Read & Write	Adapter I/O

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
235	DATA OUT A2	Param#	0	308	0	Read & Write	Adapter I/O
236	DATA OUT B1	Param #	0	308	0	Read & Write	Adapter I/O
237	DATA OUT B2	Param #	0	308	0	Read & Write	Adapter I/O
238	DATA OUT C1	Param #	0	308	0	Read & Write	Adapter I/O
239	DATA OUT C2	Param #	0	308	0	Read & Write	Adapter I/O
240	DATA OUT D1	Param #	0	308	0	Read & Write	Adapter I/O
241	DATA OUT D2	Param #	0	308	0	Read & Write	Adapter I/O
242	ADPT IO 1		*FUTURE*	*USE*			Adapter I/O
243	ADPT IO 2		*FUTURE*	*USE*			Adapter I/O
244	ADPT IO 3		*FUTURE*	*USE*			Adapter I/O
245	ADPT IO 4		*FUTURE*	*USE*			Adapter I/O
246	ADPT IO 5		*FUTURE*	*USE*			Adapter I/O
247	PROCESS 1 PAR	Numeric	0	308	5	Read & Write	Process Display
248	PROCESS 1 SCALE	Scale x 100	–327.68	+327.67	1.00	Read & Write	Process Display
249	PROCESS 1 TEXT 1	ASCII	32	127	86	Read & Write	Process Display
250	PROCESS 1 TEXT 2	ASCII	32	127	111	Read & Write	Process Display
251	PROCESS 1 TEXT 3	ASCII	32	127	108	Read & Write	Process Display
252	PROCESS 1 TEXT 4	ASCII	32	127	116	Read & Write	Process Display
253	PROCESS 1 TEXT 5	ASCII	32	127	115	Read & Write	Process Display
254	PROCESS 1 TEXT 6	ASCII	32	127	32	Read & Write	Process Display
255	PROCESS 1 TEXT 7	ASCII	32	127	32	Read & Write	Process Display
256	PROCESS 1 TEXT 8	ASCII	32	127	32	Read & Write	Process Display
257	PROCESS 2 PAR	Numeric	0	308	6	Read & Write	Process Display
258	PROCESS 2 SCALE	Scale x 100	–327.68	+327.67	1.00	Read & Write	Process Display
259	PROCESS 2 TEXT 1	ASCII	32	127	65	Read & Write	Process Display
260	PROCESS 2 TEXT 2	ASCII	32	127	109	Read & Write	Process Display
261	PROCESS 2 TEXT 3	ASCII	32	127	112	Read & Write	Process Display
262	PROCESS 2 TEXT 4	ASCII	32	127	115	Read & Write	Process Display
263	PROCESS 2 TEXT 5	ASCII	32	127	32	Read & Write	Process Display
264	PROCESS 2 TEXT 6	ASCII	32	127	32	Read & Write	Process Display
265	PROCESS 2 TEXT 7	ASCII	32	127	32	Read & Write	Process Display
266	PROCESS 2 TEXT 8	ASCII	32	127	32	Read & Write	Process Display
267	PROC DISP 1		*FUTURE*	*USE*			Process Display
268	PROC DISP 2		*FUTURE*	*USE*			Process Display
269	PROC DISP 3		*FUTURE*	*USE*			Process Display
270	PROC DISP 4		*FUTURE*	*USE*			Process Display
271	PROC DISP 5		*FUTURE*	*USE*			Process Display
272	E–Fld Volts Adj	Degrees	0	180	84	Tunable	Field
273	Fld Econ Delay	Min	0	27	5	Tunable	Field

PARM	NAME	UNITS	MIN	MAX	DEFAULT	TYPE	FUNCTION
274	Fld Econ Ref	%	0	100	70	Tunable	Field
275	Fld Auto Weak	Numweic	0	1	1	Tunable	Field
276	Field Delta Hi Lim	Degrees	0	180	130	Configurable	Field
277	Fld Loss Level	%	0	100	60	Tunable	Field
278	Fld Lp lead Freq	RD/S	0	282.7	10	Tunable	Field
279	Fld Loop Kp		0.01	128.0	0.30	Tunable	Field
280	Fld Reference	Amps	0	128.0	0.00	Tunable	Field
281	Fld Loop K–Fdbk		.900	1.010	1.000	Tunable	Field
282	Fld Weak Freq	RD/S	0	282.7	0.30	Tunable	Field
283	Fld Weaken KP		0.01	128	0.80	Tunable	Field
284	Fld Weaken Level	Volt	0	4095	228	Configurable	Field
285	FIELD 1	*(Hidden)*	*FUTURE*	*USE*			Field
286	FIELD 2	*(Hidden)*	*FUTURE*	*USE*			Field
287	FIELD 3	*(Hidden)*	*FUTURE*	*USE*			Field
288	FIELD 4	*(Hidden)*	*FUTURE*	*USE*			Field
289	FIELD 5	*(Hidden)*	*FUTURE*	*USE*			Field
290	OCL Fdbk Source	Selection	0	10	1	Configurable	Process PI
291	OCL LeadLag Freq	rad/sec	0.01	6.98	1.00	Configurable	Process PI
292	OCL LeadLag Ratio	Numeric	2	20	10	Configurable	Process PI
293	OCL LeadLag Type	Selection	0	2	1	Configurable	Process PI
294	OCL KP		0.10	128.0	2.0	Tunable	Process PI
295	OCL Lead Freq	RD/S	0	141.37	1.0		Process PI
296	OCL Pos Limit	%	0	100	100	Tunable	Process PI
297	OCL Neg Limit	%	0	100	100	Tunable	Process PI
298	OCL Ramp Time	sec	0	300	10	Tunable	Process PI
299	OCL Reference	CNTS	–4095	4095	0		Process PI
300	OCL Ref Rounding	%	0	50	0		Process PI
301	OCL Ref Source	Selection	0	9	0	Configurable	Process PI
302	OCL Trim Range	%	0	100	0		Process PI
303	OCL Enable	Enum	0	1	1		Process PI
304	PROC PI 1	*(Hidden)*	*FUTURE*	*USE*			Process PI
305	PROC PI 2	*(Hidden)*	*FUTURE*	*USE*			Process PI
306	PROC PI 3	*(Hidden)*	*FUTURE*	*USE*			Process PI
307	PROC PI 4	*(Hidden)*	*FUTURE*	*USE*			Process PI
308	PROC PI 5	*(Hidden)*	*FUTURE*	*USE*			Process PI

Parameter Descriptions (By Parameter Group)

This section provides a list of 1397 parameters sorted into their respective parameter groups with their associated default values, Display/Drive units, description and group designation and any applicable enums.

Tunable – Parameter can be changed while the drive is running.
Configurable – Parameter can only be changed when the drive is not running.

To help differentiate parameter names and display text from other text in this manual, the following conventions will be used:

- Parameter names will appear in **[Brackets]**
- Display text will appear in “quotes”.

METERING

[Anlg In 1] — P.001

Analog reference 1 value measured by the drive after all hardware and software scaling.

Display/Drive Units:	RPM
Group:	Metering
Parameter Type	Output
Factory Default	0
Minimum Value	–5369
Maximum Value	5369

[Anlg In 2] — P.002

Analog reference value measured by the drive after all hardware and software scaling.

Display/Drive Units:	RPM
Group:	Metering
Parameter Type:	Output
Factory Default	0
Minimum Value	–5369
Maximum Value	5369

[Anlg In 3] — P.003

Only used if the I/O Expansion kit is installed.

The value representing analog input 3 (terminals 50 and 51 on the I/O Expansion board) after gain and zero have been applied. Refer to the **I/O Expansion Inputs** (Fig. A.2) block diagram for additional information.

Display/Drive Units:	CNTS
Group:	Metering
Parameter Type	Output
Factory Default	0
Minimum Value	–5369
Maximum Value	5369

METERING

[Anlg In 4] — P.004

Only used if the I/O Expansion kit is installed.

The value representing analog input 4 (terminals 50 and 51 on the I/O Expansion board) after gain and zero have been applied.

Display/Drive Units:	CNTS
Group:	Metering
Parameter Type:	Output
Factory Default	0
Minimum Value	–5369
Maximum Value	5369

[Arm Volt] — P.005

Armature voltage value after all hardware and software scaling but before any IR compensation.
Actual Min/Max values will be determined by Motor Arm Volts (P. 046) or Max Motor Speed (P.041)

Display/Drive Units:	Volts
Group:	Metering
Parameter Type:	Tunable
Factory Default:	0
Minimum Value:	–675
Maximum Value:	675

[Cur Loop Fdbk] — P.006

The Cur Loop Fdbk signal prior to the summing function.

Display/Drive Units	AMPS
Group:	Metering
Parameter Type:	
Factory Default:	0
Minimum Value:	–2400
Maximum Value:	2400

[Curr Loop Error] — P.007

The Curr Loop Error signal — The difference between **[Cur Loop Ref]** and **[Cur Loop Fdbk]**.

Display/Drive Units:	AMPS
Group:	Metering
Parameter Type:	
Factory Default:	0
Minimum Value:	–3840
Maximum Value:	3840

METERING

[Cur Loop Ref] — P.008

The amplitude and rate limited value of the selected Current Loop Reference.

Display/Drive Units:	AMPS
Group:	Metering
Parameter Type:	
Factory Default:	0
Minimum Value:	–1440
Maximum Value:	1440

[Draw Percent Out] — P.009

Determined by the selected trim reference signal and **[Trim Range]** value. **[Draw Percent Out]** is used as a multiplier in the proportional trim mode for accel and decel rates. It is also used to generate the **[Trim Output]** value.

Display/Drive Units:	%
Group:	Metering
Parameter Type	Read Only – Output
Factory Default:	0
Minimum Value:	+/– 0.10
Maximum Value:	+/– 100.0

[Field Feedback] — P.010

Motor field current feedback signal after scaling and gain. Used by the field current regulator and field loss detection circuit.

Display/Drive Units:	AMPS
Group:	Metering
Parameter Type	
Factory Default:	0
Minimum Value:	–0.0
Maximum Value:	20.0

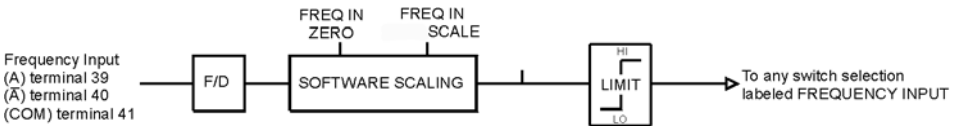
[Frequency In] — P.011

Only used if the I/O Expansion kit is installed. Gain adjustment for analog input 1 (terminals 50 and 51 on the I/O Expansion board).

The digital value of the frequency input (terminals 39, 40, and 41 on the I/O Expansion board). **Freq In** is scaled between **[Freq In Zero]** and **[Freq In Scale]**.

Display/ Drive Units:	kHz
Group:	Metering
Parameter Type	
Factory Default:	0
Minimum Value:	–2000
Maximum Value:	2000

Freq In is zero when the frequency at the input is less than or equal to **[Freq In Zero]**. It is 4095 when the frequency equals **[Freq In Scale]**.



METERING

[Jog Ramp Output] — P.012

An output that represents the jog reference value immediately after the jog ramp function.

Display/Drive Units:	RPM
Group:	Metering
Type:	Read Only
Factory Default:	0
Minimum Value:	–5000
Maximum Value:	5000

[Monitor 1 Output] — P.013

Shows the present state of the respective monitor (On, Off).

Display/Drive Units:	Enum Text
Group:	Metering
Factory Default:	0
Minimum Value:	0 (Off)
Maximum Value:	1 (On)

[Monitor 2 Output] — P.014

Shows the present state of the respective monitor (On, Off).

Display/Drive Units:	Enum Text
Group:	Metering
Factory Default:	0
Minimum Value:	0 (Off)
Maximum Value:	1 (On)

[MOP Output] — P.015

The output of the motor operated potentiometer (MOP).

Refer to the **[MOP Accel Time]** input parameter and block diagram for additional information.

Display/Drive Units:	RPM
Group:	Metering
Parameter Type:	Read Only
Factory Default:	0
Minimum Value:	–5000
Maximum Value:	5000

METERING

[OCL Enable TP] — P.016

The status of the outer control loop (OCL). Off indicates the OCL is disabled or held in reset (the drive is not running). On (Enabled) means it is operating.

Display/Drive Units:	Enum Text
Group:	Metering
Type:	Read Only
Factory Default:	0
Minimum Value:	0 (Disabled)
Maximum Value:	1 (Enabled)

[OCL Feedback] — P.017

The feedback value of the outer control loop. Refer to the **[Outer Control Loop]** (Fig. A.5) block diagram for additional information.

Display/Drive Units:	CNTS
Group:	Metering
Factory Default:	0
Minimum Value:	–5120
Maximum Value:	5120

[OCL Output] — P.018

The output of the outer control loop in speed units. This is the OCL trim that is applied to the speed/voltage control loop. Refer to the **[Outer Control Loop]** block diagram (Fig. A.5) for additional information.

Display/Drive Units:	RPM
Group:	Metering
Factory Default:	0
Minimum Value:	–5000
Maximum Value:	5000

[OCL Ramp Output] — P.019

The outer control loop reference ramp output in OCL user units. This is the OCL reference output after OCL reference rounding and S-curve have been applied. Refer to the **[OCL Ramp Time]** block diagram for additional information.

Display/Drive Units:	CNTS
Group:	Metering
Factory Default:	0
Minimum Value:	–4095
Maximum Value:	4095

[OCL Reference TP] — P.020

The value of the currently selected OCL Reference Source.

Display/Drive Units:	CNTS
Parameter Type:	Read Only
Group:	Metering
Factory Default:	0
Minimum Value:	–4095
Maximum Value:	4095

METERING

[Spd Loop Error] — P.021

The speed loop error signal, which represents the difference between the **[Spd Loop Ref]** and the **[Spd Loop Fdbk]** signals.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–8190
Maximum Value:	8190

[Spd Loop Fdbk] — P.022

An output that represents the selected speed/voltage loop drive feedback value after all scaling.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–4095
Maximum Value:	4095

[Spd Loop Lag Out] — P.023

An output representing the value immediately after the Speed Loop Lag function.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–4095
Maximum Value:	4095

[Spd Loop Output] — P.024

Speed Loop PI function output value to the Current Loop.

Display/Drive Units:	AMPS
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–1440.0
Maximum Value:	1440.0

METERING

[Spd Loop Ref] — P.025

An output that represents the reference value to be used by the speed loop regulator in the drive.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–5000.0
Maximum Value:	5000.0

[Spd Src Output] — P.026

The user selected speed reference source value. It is an input to the speed reference ramp section.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–5000.0
Maximum Value:	5000.0

[Spd Ramp In TP] — P.027

An output that represents the test point value immediately before the speed loop ramp function.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–5000.0
Maximum Value:	5000.0

[Spd Ramp Output] — P.028

An output that represents the test point value immediately after the speed loop ramp function.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–5000.0
Maximum Value:	5000.0

METERING

[Speed Pot] — P.029

Analog reference value, scaled to max and min Process Speed, measured by the drive after all hardware and software scaling.

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–5000.0
Maximum Value:	5000.0

[Trim Output] — P.030

Shows the value of trim that will be added to speed reference[**Spd Src Output**]
Actual Min/Max values will be determined by Motor Arm Volts (P. 046) or Max Motor Speed (P.041)

Display/Drive Units:	RPM
Group:	Metering
Type:	
Factory Default:	0
Minimum Value:	–5000.0
Maximum Value:	5000.0

[Torque Reference] — P.031

Shows the value (in amps) of the currently selected reference to the drive (see Fig. A.3).

Display/Drive Units:	AMPS
Group:	Metering
Type:	
Factory Default:	O
Minimum Value:	–960.0
Maximum Value:	960.0

SETUP

[CT Turns Ratio] — P.036

The drive current transformer turns ratio (Tp/Tn).

See Regulator board replacement instructions for information on determining the CT TURNS RATIO. This parameter is not restored if a Restore Defaults is done.

Display/Drive Units:	Tp/Tn
Parameter Type:	Configurable
Group:	Setup
Factory Default:	Value varies per HP rating (See table below)
Minimum Value:	1
Maximum Value:	32767

ATTENTION: The **[CT Turns Ratio]** parameter is also used in the calculation of the burden resistor value. Do not adjust/change the value of this parameter from its factory set value unless you are replacing the regulator board (see chart below). Failure to observe this precaution could result in damage to, or destruction of, the equipment.

The Drive Current Transformer Turns Ratio (Tp/Tn):	Value to Enter
1.5 HP at 230 V AC/3 HP at 460 V AC	139
2-7.5 HP at 230 V AC/5-15 HP at 460 V AC	208
10-15 HP at 230 V AC/20-30 HP at 460 V AC	417
20-30 HP at 230 V AC/40-60 HP at 460 V AC	833
40-75 HP at 230 V AC/75-150 HP at 460 V AC	2000
100-150 HP at 230 V AC/200-300 HP at 460 V AC	5230
400–600 HP at 460VAC	7770
7 Amps at 380/415 VAC	139
29 Amps at 380/415 VAC	208
55 Amps at 380/415 VAC	417
110 Amps at 380/415 VAC	833
265 Amps at 380/415 VAC	2000

[Accel Time] — P.037

Amount of time it will take the drive to reach **[Max Motor Speed]** from 0 speed. Smaller changes in speed will take proportionately less time.

In proportional trim mode, the actual time to accelerate will be modified by **[Draw Percent Out]**.

Refer to the **Speed Reference Ramp, Fig. A.4** block diagram, for additional information.

Display/Drive Units:	SECONDS
Group:	Setup
Type:	Tunable
Factory Default:	5.0
Minimum Value:	0.1
Maximum Value:	300.0

SETUP

[Decel Time] — P.038

Selects the time it takes to decelerate from **[Max Motor Speed]** to 0. Smaller changes in speed take proportionately less time.

If **[Trim Mode Type]** is set to **[Proportional]**, the actual time to decelerate might be modified by **[Draw Percentage Out]**. Refer to the Speed Reference Ramp Block illustration (A.4) for more information.

Display/Drive Units:	SECS
Group:	Setup
Type:	Tunable
Factory Default:	5.0
Minimum Value:	0.1
Maximum Value:	300.0

[Feedback Type] — P.039

Selects the type of feedback signal that is used for the speed/voltage loop.

0 = Arm Volt
1 = DC Tach
2 = Pulse Encoder
3 = AC Tach

Display/Drive Units:	Numeric
Group:	Setup
Type:	Configurable
Factory Default:	0 (Arm Volt)
Minimum Value:	0 (Arm Volt)
Maximum Value:	3 (AC Tach)

[Maximum Current] — P.040

The highest amount of current (positive or negative) for a given application. This input is used as the basis of armature current scaling. **[Maximum Current]** is limited to 200% of **[Motor Arm Amps]**.

Display/Drive Units:	% FLA
Group:	Setup
Type:	Configurable
Factory Default:	150
Minimum Value:	25
Maximum Value:	200

[Max Motor Speed] — P.041

[Max Motor Speed] is the highest normal running speed of the motor. This parameter scales the feedback device.

[Max Motor Speed] depends on several factors:

- If there is no field weakening, the top speed is typically the same as the motor nameplate base speed.
- If there is field weakening, the top speed is the same as the field weakened speed. Top speed is typically more than the base speed when field weakening is applied.

Display/Drive Units:	RPM
Group:	Setup
Type:	Configurable
Factory Default:	500
Minimum Value:	5
Maximum Value:	5000

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

SETUP

[Max Process Spd] — P.042

The maximum speed of the drive that can be supported by the application or process. **[Max Process Spd]** can be less than or equal to **[Max Motor Speed]**.

If raising this value causes **[Min Process Speed]** to become less than 10% of **[Max Process Spd]**, an alarm is generated.

Display/Drive Units:	RPM
Group:	Setup
Parameter Type:	Tunable
Factory Default:	500 RPM
Minimum Value:	1 RPM
Maximum Value:	Max Motor Speed

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

ATTENTION: When performing this adjustment, do not allow the motor to exceed the maximum safe speed of the driven equipment as determined by the equipment manufacturer. Failure to observe this precaution could result in bodily injury.

[Min Process Spd] — P.043

Selects the minimum speed of the drive without being stopped. It is typically greater than zero. If it is less than 10% of **[Max Process Spd]**, an alarm is generated.

NOTE: This alarm will only occur after a speed change, not on power up.

Display/Drive Units:	RPM
Parameter Type:	Tunable
Group:	Setup
Factory Defaul:	250 RPM
Minimum Value:	0 RPM
Maximum Value:	Max Process Speed

ATTENTION: This drive can operate at and maintain zero speed when this parameter is set to zero. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

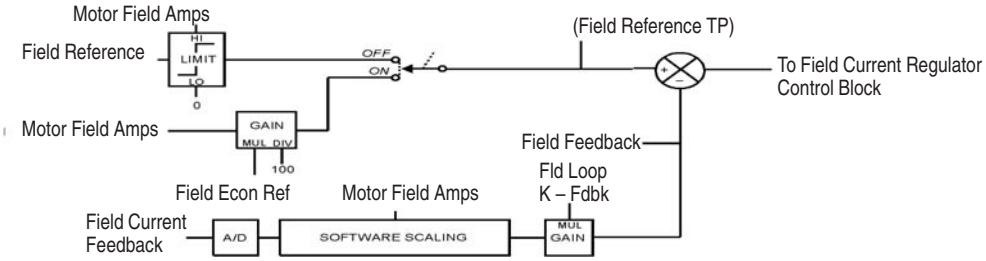
SETUP

[Motor Field Amps] — P.044

Motor nameplate value of the rated field amps. This parameter scales the field current feedback. Minimum and maximum values are dependent on the installed supply rating.

Display/Drive Units:	Amps
Parameter Type:	Configurable
Group:	Setup
Factory Defaut	0.01 amp
Minimum Value:	0.11 (4 amp) 0.28 (10 amp) 0.55 (20 amp)
Maximum Value:	4.00 (4 amp) 10.00 (10 amp) or 20.00 (20 amp)

ATTENTION: The incorrect setting of this parameter can cause a motor overvoltage condition. Set motor **[Motor Field Amps]** to the motor's nameplate value. Make sure **[Field Econ Ref]** and/or **[Field Reference] — P.280** is set greater than **[Fld Loss Level] — P.277** to guard against field loss faults. Failure to observe this precaution can result in bodily injury and damage to the equipment.



[Motor Arm Amps] — P.045

The rated armature current from the motor nameplate.

Display/Drive Units:	Amps
Parameter Type:	Configurable
Group:	Setup
Factory Default:	8.0
Minimum Value:	0.1
Maximum Value:	3000.0

ATTENTION: The drive will not operate properly if this parameter value is entered incorrectly. This parameter must be equal to the rated armature amps found on the motor nameplate. Overcurrent or excess heating of the motor could result. Failure to observe this precaution could result in damage to, or destruction of, the equipment.

SETUP

[Motor Arm Volts] — P.046

The rated armature voltage from the motor nameplate.

Display/Drive Units:	
Parameter Type:	Configurable
Group:	Setup
Factory Default:	240
Minimum Value:	160
Maximum Value:	675

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

[Anlg Tach V/1000] — P.047

The analog tachometer scaling from the tachometer nameplate in volts per 1000 RPM. Units are volts DC for DC tachometers or volts AC RMS for AC tachometers.

Note: The use of an AC tachometer requires the AC Tachometer Feedback kit.

Display/Drive Units:	V/1K
Parameter Type:	Configurable
Group:	Setup
Factory Default:	18.0/1000 RPM
Minimum Value:	18.0
Maximum Value:	200.0

Note: The high limit might be less than 200.0 to prevent the tach voltage from exceeding 250V.

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

[Encoder PPR] — P.048

Encoder pulses per revolution (PPR) from the encoder nameplate.

Display/Drive Units:	PPR
Parameter Type:	Configurable
Group:	Setup
Factory Default:	18
Minimum Value:	18
Maximum Value:	2500

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

SETUP

[Encoder Quad] — P.049

Enables or disables encoder quadrature. Encoder quadrature must be used on regenerative drives that use an encoder.

Set On for a bidirectional encoder.

Set Off for a unidirectional encoder.

Display/Drive Units:	Numeric/Text
Parameter Type:	Configurable
Group:	Setup
Factory Default:	1
Minimum Value:	0 (Off)
Maximum Value:	1 (On)

If **[Encoder Quad]** is set to Off and Pulse Tach is the selected **[Feedback Type]** type, **[Neg Current Lim]** will be set to 0 and **[Reverse Disable]** set to On (preventing reverse direction).

[Nominal AC Freq] — P.050

The nominal AC line frequency (typically 50 or 60 Hz).

Display/Drive Units:	Hz
Parameter Type:	Configurable
Group:	Setup
Factory Default:	60
Minimum Value:	48
Maximum Value:	62

[Nominal AC Volt] — P.051

The nominal AC line RMS voltage.

Display/Drive Units:	V AC
Parameter Type:	Configurable
Group:	Setup
Factory Default:	230
Minimum Value:	200
Maximum Value:	575

[AutoTune Type] — P.052

When the Drive is “Ready”, this parameter allows selection of the Auto Tune Mode.

After selection is made, pressing Run will start the tuning mode.

Display/Drive Units:	Numeric/Text
Parameter Type:	Configurable
Group:	Setup
Factory Default:	0
Minimum Value:	0
Maximum Value:	3
Enums:	0 = None, 1 = Current+Spd, 2 = Current Loop, 3 = Spd Loop

ADV SETUP

[Anlg Tach Gain] — P.057

Used to scale the analog tachometer feedback signal after it has been conditioned by the drive hardware. Typically, it will be 1.000.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	1.000
Minimum Value:	0.750
Maximum Value:	1.250

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

[Anlg Tach Zero] — P.058

Used to remove any hardware-introduced offset from the analog tachometer feedback signal. Typically, adjustment will be –20 to +20.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

[Arm Voltage Gain] — P.059

Used to scale the armature voltage signal after it has been conditioned by the drive hardware. In most cases, this input will be 1.000.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	1.000
Minimum Value:	0.750
Maximum Value:	1.250

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

ADV SETUP

[Arm Voltage Zero] — P.060

Used to remove any hardware-introduced offset from the armature voltage signal. In most cases, this input will be set to zero volts.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

ATTENTION: The incorrect setting of this parameter can cause an overspeed condition. This parameter must be set by a qualified person who understands the significance of setting it. Set the value of this parameter accurately per your application requirements. Failure to observe this precaution could result in bodily injury.

[Cur Loop K Fdbk] — P.061

Current Loop Feedback gain adjustment. In most cases, this input will be set for unity gain. The range of this input may be affected by the software scaling factor calculated by the drive. Typically, it will be 1.000.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	1.000
Minimum Value:	1.000
Maximum Value:	1.100

[Cur Lp Lead Freq] — P.062

Lead break frequency for the Current Loop.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	100
Minimum Value:	10
Maximum Value:	500

[Cur Loop Kp] — P.063

Proportional gain for the Current Loop.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	0.250
Minimum Value:	0
Maximum Value:	4.000

ADV SETUP

[Cur Loop RateLim] — P.064

Minimum allowable time for selected Current Loop reference to change from zero to **[Maximum Current]**.

Display/Drive Units:	MSEC
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	40
Minimum Value:	1.000
Maximum Value:	100

[IR Compensation] — P.066

Sets the armature voltage compensation value used when the drive is configured as a voltage regulator. This parameter is also used by the field current regulator to set the field weakened threshold.

Display/Drive Units	% [Motor Arm Volts (P046)]
Group:	Advanced Setup
Factory Default:	0
Minimum Value:	0
Maximum Value:	50%

[Pos Current Lim] — P.067

Sets the highest amount of current (% motor rated armature amps) for the forward bridge. Used as a high limit for the speed loop PI block output.

Display/Drive Units:	% FLA
Parameter Type:	Tunable
Group:	Advanced Set–Up
Factory Default:	150%
Minimum Value:	0
Maximum Value:	Max Setting of Param 040 *Note: Setting of this parameter is limited by the setting of Parm 040.*

[Neg Current Lim] — P.068

Note: This parameter is only set for regenerative drives.

Selects the highest amount of current (% motor rated armature amps) for the reverse bridge. Used as a low limit for the Speed Loop PI block output.

Display/Drive Units:	% FLA
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	150%
Minimum Value:	0
Maximum Value:	200%

ADV SETUP

[Pos Cur Lim Src] — P.069

Selects the source for the positive current limit.

If Register is selected, the reference is **[Pos Cur Lim]**.

The I/O Expansion kit must be installed to use Analog In 3 (terminals 50 and 51 on the I/O Expansion board), Analog In 4 (terminals 52 and 53), or Frequency In (terminals 39, 40, and 41).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Register 1 = Analog In 3 2 = Analog In 4 3 = Frequency In 4 = Adapter 1 5 = Adapter 2 6 = Adapter 3 7 = Adapter 4 8 = Adapter 5 9 = Adapter 6
Default Setting:	Register
Parameter Type:	Configurable
Group:	Advanced Set–Up
Factory Default:	0
Minimum Value:	0
Maximum Value:	9

[Neg Cur Lim Src] — P.070

Selects the source for the negative current limit. If Register is selected, **[Neg Cur Lim]** is used as the limit.

The analog input choices are only available if the I/O Expansion kit is installed. The Network choices are only available if the Network Option kit is installed.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Register 1 = Analog In 3 2 = Analog In 4 3 = Frequency In 4 = Adapter 1 5 = Adapter 2 6 = Adapter 3 7 = Adapter 4 8 = Adapter 5 9 = Adapter 6
Default Setting:	Register
Parameter Type:	Configurable
Group:	Advanced Setup
Factory Default:	0
Minimum Value:	0
Maximum Value:	9

Note: Default is zero for non-regenerative drives, if **[Feedback Type]** is set to AC Tach, or if **[Feedback Type]** is set to Encoder and **[Encoder Quad]** is off.

ADV SETUP

[PLL Max Error] — P.071

Maximum allowable change in line period per AC line cycle. This input should only be increased when drive power is supplied by a source that cannot maintain a suitable fixed frequency output (such as an alternator) to prevent line synchronization-related faults.

Display/Drive Unitse:	uSEC
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	2
Minimum Value:	2
Maximum Value:	1000

[Spd LeadLag Freq] — P.072

If Lead/Lag is selected in **[Spd Leadlag Type]**, this parameter represents the low lead frequency. If **[Spd Leadlag Type]** is set to Bypass, this parameter has no effect. If Lag/Lead is selected, it represents the low lag frequency.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	100
Minimum Value:	1
Maximum Value:	3490

[Spd LeadLag Rato] — P.073

Sets the ratio of low to high break frequencies for the lead/lag block. For example, if this parameter is set to 10, the high break frequency will be 10 times the low break frequency — specified by **[Spd Leadlag Freq]**. If **[Spd Leadlag Type]** is set to Bypass, this parameter has no effect.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	2
Minimum Value:	2
Maximum Value:	20

[Spd LeadLag Type] — P.074

Determines if the lead/lag block will act upon the speed loop feedback signal. If On, the lead/lag block is bypassed and the feedback signal is used directly by the speed loop summing junction.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Lead/Lag 1 = Bypass 2 = Lag/Lead
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	1
Minimum Value:	0
Maximum Value:	2

ADV SETUP

[Spd Lp Lag Freq] — P.075

Lag break frequency for the lag block. If **[Spd Lp Lag Type]** is set to Bypass, this parameter has no effect.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	1.00
Minimum Value:	0.01
Maximum Value:	69.81

[Spd Lp Lag Type] — P.076

Determines if the lead/lag block will act upon the speed loop feedback signal. If On, the lead/lag block is bypassed and the feedback signal is used directly by the speed loop summing junction.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Lag 1 = Bypass
Default Setting:	Bypass
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	1
Minimum Value:	0
Maximum Value:	1

[Spd Lp Lead Freq] — P.077

Speed loop PI block lead frequency. A setting of 0.00 allows proportional-only speed loop control.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	3.00 rad/sec
Minimum Value:	0 rad/sec
Maximum Value:	141.37 rad/sec

[Spd Loop Kp] — P.078

Speed loop PI block proportional gain. Refer to Fig A.7, Speed Loop Block Diagram for more information.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Advanced Setup
Factory Default:	4.40
Minimum Value:	0.10
Maximum Value:	128.0

[Tach Loss Angle] — P.079

Allows setting of Armature Delta firing angle before a Tach Loss fault will be generated.

Display/Drive Units:	Degrees
Parameter Type:	Configuration
Group:	Advanced Setup
Factory Default:	109
Minimum Value:	0
Maximum Value:	127

REFERENCE SET

[MOP Accel Time] — P.084

Only available if the I/O Expansion kit is installed.

Time in which the motor operated potentiometer (MOP) output can change from zero to **[Max Motor Speed]**.

The MOP function provides a manual reference to the speed/voltage loop when the MOP output is selected.

Display/Drive Units:	SEC
Parameter Type:	Tunable
Group:	Reference Set
Factory Default:	0.1 sec. or drive accel rate, whichever is highest
Minimum Value:	1.0 sec
Maximum Value:	300.0 sec.

The **[Mop Output]** is increased through digital input 4 (terminal 63) and decreased through digital input 3 (terminal 62) on the I/O Expansion board. The **[Mop Output]** is limited to prevent going over **[Max Process Spd]** or under **[Min Process Spd]**.

[Mop Accel Time] and **[Mop Decel Time]** set the time in which the **[Mop Output]** can change from zero to **[Max Motor Speed]** and vice versa. To prevent the S-curve block from limiting the rate of change from the **[Mop Output]**, **[Mop Accel Time]** has a low limit equal to **[Accel Time]**. **[Mop Decel Time]** has a low limit equal to **[Decel Time]**.

When **[Mop Reset Enable]** is on, the MOP output goes to **[Minimum Speed]** when the drive stops. If it is off, the **[Mop Output]** remains at its present level when the drive stops.

[MOP Decel Time] — P.085

Only used if the I/O Expansion kit is installed.

Minimum time in which the **[Mop Output]** can change from **[Max Motor Speed]** to zero. Refer to the **[Mop Accel Time]** parameter and block diagram for additional information.

Display/Drive Units:	SEC
Parameter Type:	Tunable
Group:	Reference Set
Factory Default:	0.1 sec. or drive decel rate whichever is highest
Minimum Value:	1.0 sec
Maximum Value:	300.0 sec.

[MOP Reset Enable] — P.086

Determines if the **[Mop Output]** resets or stays at the present level when the drive stops. When **[Mop Reset Enable]** is on, the MOP output goes to **[Min Process Speed]** when the drive stops. If it is off, the **[Mop Output]** remains at its present level when the drive stops.

Refer to the **[Mop Accel Time]** parameter and block diagram for additional information.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Reference Set
Factory Default:	0 (Off)
Minimum Value:	0 (Off)
Maximum Value:	1 (On)

REFERENCE SET

[Preset Speed 1, 2 and 3] — P.87, P.88 and P.89

These parameters set up to three preset speed references when the Regulator Type jumper (J15 on the regulator board) is set for the speed/voltage control loop or current reference when J15 is set to current.

Display/Drive Units:	%FLA
Parameter Range:	0 to **[Maximum Current]** — %FLA
Default Setting:	150 %FLA
Parameter Type:	Tunable
Group:	Reference Set
Display/Drive Units:	RPM ***OR***
Parameter Range:	**[Min Process Speed]** to **[Max Process Speed]** RPM
Default Setting:	250 RPM
Parameter Type:	Tunable
Group:	Reference Set
Factory Default:	250
Minimum Value:	Min Process Speed
Maximum Value:	Max Process Speed

[Ref 1 Source] — P.090

Selects the source of external reference 1

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Anlg In 1 1 = Speed Pot 2 = MOP Output 3 = Anlg In 3 4 = Anlg In 4 5 = Frequency In 6 = Adapter 1 7 = Adapter 2 8 = Adapter 3 9 = Adapter 4 10 = Adapter 5 11 = Adapter 6 12 = Preset 1 13 = Preset 2 14 = Preset 3
Parameter Type:	R & W
Group:	Reference Set
Factory Default:	0
Minimum Value:	0
Maximum Value:	14

REFERENCE SET

[Ref 2 Source] — P.091

Selects the source of external reference 2.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Anlg In 1 1 = Speed Pot 2 = MOP Output 3 = Anlg In 3 4 = Anlg In 4 5 = Frequency In 6 = Adapter 1 7 = Adapter 2 8 = Adapter 3 9 = Adapter 4 10 = Adapter 5 11 = Adapter 6 12 = Preset 1 13 = Preset 2 14 = Preset 3
Parameter Type:	R & W
Group:	Reference Set
Factory Default:	1
Minimum Value:	0
Maximum Value:	14

[Jog Acc/Dec Time] — P.092

Sets the time it takes the jog reference circuit to reach **[Jog Reference (P.093)]** from zero. Smaller changes in speed take proportionally less time.

The **[S-Curve Rounding]** parameter does not affect the setting of this parameter.

Display/Drive Units:	SEC
Parameter Type:	Tunable
Group:	Reference Set
Factory Default:	3.0
Minimum Value:	0.1
Maximum Value:	300.0

[Jog Reference] — P.093

The normal operating speed while the drive is jogging.

Display/Drive Units:	RPM
Parameter Type:	Tunable
Group:	Reference Set
Factory Default:	250
Minimum Value:	0
Maximum Value:	Max Process Speed

ATTENTION: This drive can operate at and maintain zero speed when this parameter is set to zero. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

REFERENCE SET

[Jog Off Dly Time] — P.094

Sets the amount of delay from releasing the Jog until the drive contactor opens. Allows repeated jogging without cycling the contactor.

Display/Drive Units:	SEC
Parameter Type:	Configurable
Group:	Reference Set
Factory Default:	1
Minimum Value:	0
Maximum Value:	10

FEATURE SELECT

[Min Speed Bypass] — P.099

Disables the **[Min Process Spd]** limit when "ON". When "Off" the [Min Process Spd] is the lower limit.

Display/Drive Units:	Numeric/Text
Parameter Type:	Selectable
Group:	Feature Select
Factory Default:	0
Minimum Value:	0 = Off
Maximum Value:	1 = On

ATTENTION: This drive can operate at and maintain zero speed when this parameter is set to on. The user is responsible for assuring safe conditions for operating personnel by providing suitable guards, audible or visual alarms, or other devices to indicate that the drive is operating at or near zero speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

[Ref Ramp Bypass] — P.100

Bypasses the Speed Loop Ramp block. The bypass is automatically overridden during a stop command.

Note: If bypassed, rapid speed change can result.

Display/Drive Units:	Numeric/Text
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0
Minimum Value:	0 = Off
Maximum Value:	1 = On

[Current Compound] — P.101

Sets the level of current compounding to be used during any mode of drive operation.

Display/Drive Units:	%FLA
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0%
Minimum Value:	–50%
Maximum Value:	50%

FEATURE SELECT

[Inertia Comp Src] — P.102

Sets the source of the inertia compensation signal.
Internal uses [Normal Inertia] and [Maximum Current] params to determine amount of inertia compensation.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = NONE 1 = INTERNAL 2 = ANLG IN 3 3 = ANLG IN 4 4 = FREQUENCY IN 5 = ADAPTER 1 6 = ADAPTER 2 7 = ADAPTER 3 8 = ADAPTER 4 9 = ADAPTER 5 10 = ADAPTER 6
Group:	Feature Select
Factory Default:	0
Minimum Value:	0
Maximum Value:	10

[Monitor 1 Delay] — P.103

The delay time in seconds for the level detector 1 circuit. Sets the amount of time between when the level detector timer is triggered and when the output is set on. If the input source signal goes below the detector's threshold value, the timer is immediately reset. Refer to the **Level Detectors** block diagram (Fig. A.12) for additional Information.

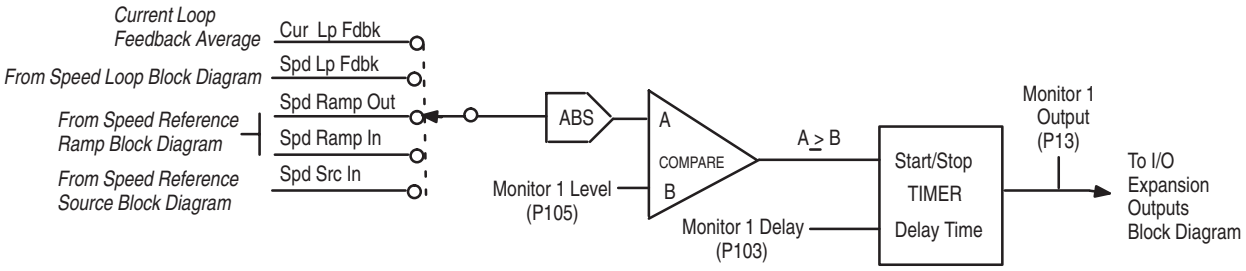
Display/Drive Units:	SECS
Default Setting:	10.0 seconds
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	1.0
Minimum Value:	0
Maximum Value:	300.0

FEATURE SELECT

[Monitor 1 Source] — P.104

Selects the signal that drives monitor 1.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Cur Lp Fdbk 1 = Spd Lp Fdbk 2 = Spd Ramp Out 3 = Spd Ramp In 4 = Spd Src Out
Parameter Type:	Configurable
Group:	Feature Select
Factory Default:	1 (Spd Lp Fdbk)
Minimum Value:	0
Maximum Value:	4



[Monitor 1 Level] — P.105

The threshold for level detector 1. Refer to the **Level Detectors** block diagram (Fig. A.12) for additional information.

When the absolute value of the signal driving monitor 1 is ≥ this threshold, the associated timer starts. If the input signal is < this threshold, the timer is immediately reset and the level detector output is set to off.

Display/Drive Units:	%
Default Setting:	10.0%
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	10.0%
Minimum Value:	0.1%
Maximum Value:	100.0%

The parameter range for the level detector is automatically rescaled for speed or current based on the input selected by **[Monitor 1 Source]**. If **[Cur Loop Fdbk]** is selected for **[Monitor 1 Source]**, the parameter range is 0.1 to **[Maximum Current]**. For any other **[Monitor 1 Source]** settings, the parameter range is 0.1 to 100.0%.

FEATURE SELECT

[Monitor 2 Delay] — P.106

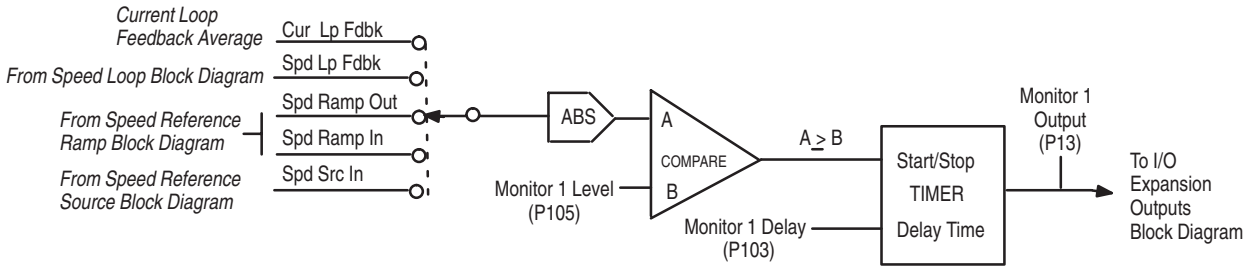
The delay time in seconds for the monitor 2 circuit. Refer to the **Level Detectors** block diagram (A.12) for additional Information.

Display/Drive Units:	SECS
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	1.0 seconds
Minimum Value:	0 seconds
Maximum Value:	30.0 seconds

[Monitor 2 Source] — P.107

Selects the signal that drives monitor 2.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Cur Lp Fdbk 1 = Spd Lp Fdbk 2 = Spd Ramp Out 3 = Spd Ramp In 4 = Spd Src Out
Parameter Type:	Configurable
Group:	Feature Select
Factory Default:	3 (Spd Ramp In)
Minimum Value:	0
Maximum Value:	4



FEATURE SELECT

[Monitor 2 Level] — P.108

The threshold for monitor 2. Refer to the **Level Detectors** block diagram (Fig. A.12) for additional information.

Display/Drive Units:	%
Default Setting:	10.0%
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	10.0%
Minimum Value:	0.1%
Maximum Value:	100.0%

The parameter range for the level detector is automatically rescaled for speed or current based on the input selected by **[Monitor 2 Source]**. If **[Cur Loop Fdbck]** is selected for **[Monitor 2 Source]**, the parameter range is 0.1 to **[Maximum Current]**. For any other **[Monitor 2 Source]** settings, the parameter range is 0.1 to 100.0%.

[Normal Inertia] — P.109

The time required to accelerate the motor and load inertia from zero to motor base speed at **[Motor Arm Amps]** and **[Motor Field Amps]**.

This parameter is set by the speed loop self-tuning procedure or is entered by the operator directly.

Display/Drive Units:	SECS
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	1.00 seconds
Minimum Value:	0.05 seconds
Maximum Value:	65.20 seconds

[Reverse Disable] — P.110

Note: **[Reverse Disable]** applies only to regenerative drives.

When On, **[Reverse Disable]** prevents the speed reference from dropping below zero. The reverse bridge cannot be activated and the drive cannot reverse.

When Off, the speed reference can drop below zero and the drive can reverse.

The default is on when:

- The drive has a non-regenerative (S6) power unit.
- **[Feedback Type]** is set to AC Tach.
- **[Feedback Type]** is set to Encoder and [Encoder Quad] is Off.

Display/Drive Units:	Numeric/Text
Parameter Type:	Configurable
Group:	Feature Select
Factory Default:	0 (Off)
Minimum Value:	0 = OFF
Maximum Value:	1 = ON

If **[Encoder Quadrature]** is set to Off and Pulse Tach is the selected **[Feedback Type]** type, **[Neg Current Lim]** will be set to 0 and **[Reverse Disable]** set to On (preventing reverse direction).

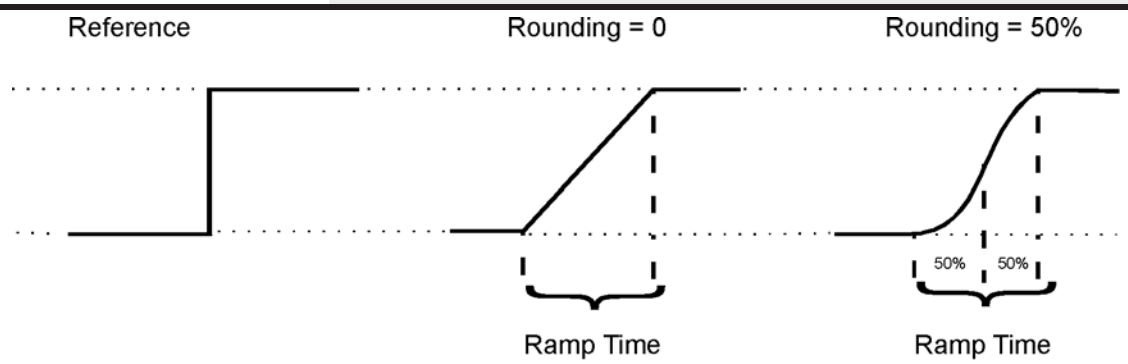
FEATURE SELECT

[S-Curve Rounding] — P.111

Rate of change (positive or negative) of acceleration and deceleration to smooth the Speed Loop Ramp output. For example, if equal to 20, then 40 % of the acceleration and deceleration time will be spent smoothing and the remainder will be a linear ramp.
0% = linear ramp, no rounding
50% = smoothing for the entire ramp

In regard to **[Trim Mode Type]**, **[S-Curve Rounding]** will interfere with the **[Accel Time]** and the **[Decel Time]** so that the draw will not be constant. Therefore, it is recommended that **[S-Curve Rounding]** be set to 0% if **[Trim Mode Type]** is set to Proportional. Incremental trim is not affected by this limitation.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0%
Minimum Value:	0%
Maximum Value:	50%



[AutoTune Bridge] — P.112

Selects the desired direction for auto tuning to operate.

Display/Drive Units:	Numeric/Text
Parameter Type:	Configurable
Group:	Feature Select
Factory Default:	0 (Forward)
Minimum Value:	0 = Forward
Maximum Value:	1 = Reverse

FEATURE SELECT

[AutoTune Fld Rng] — P.113

Set to the ratio of [Max Motor Speed] and motor base speed = 1.00 when no field weakening is used. Applies to speed loop autotuning only. The higher the value, the faster the motor speed.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	1.00
Minimum Value:	0.90
Maximum Value:	5.00

[AutoTune Stablty] — P.114

Selects the desired performance of the speed loop after auto tuning. A higher value decreases the speed loop's response.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	25
Minimum Value:	10
Maximum Value:	100

[Stop Mode Type] — P.115

Selects stopping mode of the drive in response to a Stop command. An open "customer interlock" only causes a coast stop. If the drive is configured as a current regulator, only Coast/DB can be selected.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Ramp 1 = Curr Limit 2 = Coast/DB
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	2 (Coast/DB)
Minimum Value:	0
Maximum Value:	2

[Stop Speed Level] — P.116

Sets the threshold speed below which the main contactor will automatically open after a ramp stop or current limit stop is asserted. This value should be less than or equal to **[Min Process Speed]**.

Display/Drive Units:	RPM
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	50
Minimum Value:	0
Maximum Value:	Max Process Spd

FEATURE SELECT

[Trim Mode Type] — P.117

Selects the type of trim mode to be used by the drive:

- No Trim
- Incremental
- Proportional — Allows multiple drive sections with a common reference to operate and ramp at different values.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = No Trim 1 = Incremental 2 = Proportional
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0
Minimum Value:	0
Maximum Value:	2

Proportional is a type of draw. By using draw, one section can operate 10% faster than an upstream section. When a ramp occurs on the common reference, the two sections will support the 10% draw throughout the ramp. **[S-Curve Rounding]** will interfere with the **[Accel Time]** and the **[Decel Time]** so that the draw will not be constant. Therefore, it is recommended that **[S-Curve Rounding]** be set to 0% if **[Trim Mode Type]** is set to Proportional. Incremental trim is not affected by this limitation.

This parameter also affects how the acceleration and deceleration times are interpreted.

[Trim Range] — P.118

Uses the selected trim reference signal to generate draw percentage. Determines how much the trim signal will affect the drive reference.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0%
Minimum Value:	0%
Maximum Value:	100%

[Trim Ref Source] — P.119

Trim reference source selection.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Register 1 = Anlg In 1 2 = Anlg In 2 3 = Anlg In 3 4 = Anlg In 4 5 = Frequency In 6 = Adapter 1 7 = Adapter 2 8 = Adapter 3 9 = Adapter 4 10 = Adapter 5 11 = Adapter 6
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0
Minimum Value:	0
Maximum Value:	11

FEATURE SELECT

[Trim Reference] — P.120

Drive register to manually set the trim reference value used by the drive.

Display/Drive Units:	%
Parameter Range:	±100.0%
Parameter Type:	Tunable
Group:	Feature Select
Factory Default:	0
Minimum Value:	–100%
Maximum Value:	+100%

[OCL Enable Src] — P.121

Sets the source of the OCL enable signal. "Register" means it comes from [**OCL Enable**]. "Terminal Blk" means I/O Expansion #64.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Register 1 = Terminal Blk
Group:	Feature Select
Parameter Setting:	Tunable
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

[Inertia Comp Reg] — P.122

Allows inertia compensation value to be entered (via Datalink also) when Inertia Comp Src P. 102 is set to "Register". The value of this parameter is not saved through a power–cycle, it is reset to zero at power–up.

Display/Drive Units:	CNTS Counts
Parameter Range:	0 – 4095
Group:	Feature Select
Parameter Setting:	Tunable
Factory Default:	0
Minimum Value:	0
Maximum Value:	4095

INPUT CONFIG

[Anlg In 1 Gain] — P.127

Used to scale the analog input 1 signal after it has been conditioned by the drive hardware. Typically, it will be 1.000.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Input Cong
Factory Default:	1.000
Minimum Value:	0.750
Maximum Value:	2.250

[Anlg In 1 Type] — P.128

Selects the analog input 1 signal type.

Note: Jumpers J10 and J12 must be set for the same type of signal selected by this parameter.

Display/Drive Units:	Numeric
Parameter Range:	0 = 0-10V 1 = ±10V 2 = 4-20mA 3 = 10-50mA
Parameter Type:	Configurable
Group:	Input Config
Factory Default:	0
Minimum Value:	0
Maximum Value:	3

[Anlg In 1 Zero] — P.129

Used to remove any hardware introduced offset from the analog auto reference signal. Typically, it will be 0.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Input Config
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

[Anlg In 2 Gain] — P.130

Scales the manual mode analog reference signal after it has been conditioned by the drive hardware. Typically, it will be 1.000.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Input Config
Factory Default:	1.000
Minimum Value:	0.750
Maximum Value:	2.250

INPUT CONFIG

[Anlg In 2 Zero] — P.131

Removes any hardware introduced offset from the analog reference signal. Typically, it will be 0.

Display/Drive Units:	Numeric
Parameter Range:	–200 to +200
Parameter Type:	Tunable
Group:	Input Config
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

[Anlg In 3 Gain] — P.132

Only used if the I/O Expansion kit is installed. Scales analog input 3 (Terminals 50 & 51 on the I/O Exp). Typically 1.000

Display/Drive Units:	Numeric
Group:	Input Config
Parameter Type	Tunable
Factory Default:	1.000
Minimum Value:	0.750
Maximum Value:	2.250

[Anlg In 3 Type] — P.133

Only used if the I/O Expansion kit is installed.

Selects the type of signal that the drive will expect to be connected to analog input 3 (terminals 50 and 51 on the I/O Expansion board).The value of this parameter must match the setting of jumpers J11 and J12 on the I/O Expansion board.

Refer to the **I/O Expansion Inputs (Fig. A.2**) block diagram for further information.

Display/Drive Units:	Numeric
Parameter Range:	0 = 0-10V 1 = ±10V 2 = 4-20mA 3 = 10-50mA
Default Setting:	±10V
Group:	Input Config
Factory Default:	1
Minimum Value:	0
Maximum Value:	3

INPUT CONFIG

[Anlg In 3 Zero] — P.134

Only used if the I/O Expansion kit is installed.

Adjusts the zero point of analog input 3 (terminals 50 and 51 on the I/O expansion board) to remove any offset that might exist on the input.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Input Config
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

To adjust the zero point, make small changes to this parameter until **[Anlg In 3]** (P.003) equals zero when the signal at terminals 50 and 51 is at its minimum (0 V).

[Anlg In 4 Gain] — P.135

Only used if I/O Expansion Kit Installed. Scales Analog Input 4 (Terminals 52 & 53).

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Input Config
Factory Default:	1.00
Minimum Value:	0.750
Maximum Value:	2.250

[Anlg In 4 Zero] — P.136

Only used if the I/O Expansion Kit is installed. Adjusts the zero point of Analog Input 4 (52,53) on the I/O Expansion Brd, to remove any offset that may exist on the input.

Display/Drive Units:	Numeric
Group:	Input Config
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

To adjust the zero point, make small changes to this parameter until **[Anlg In 4]** (P.004) equals zero while the signal at terminals 52 and 53 is at its minimum (0 V).

[Freq In Scale] — P.137

Only available if the I/O Expansion kit is installed.

Specifies the maximum input frequency. This is the frequency that corresponds to a full scale value. For example, if the frequency input will be used as the speed loop reference, this input frequency would correspond to **[Max Motor Speed] — P.041**, because **[Max Motor Speed]** is the basis for speed loop scaling.

Display/Drive Units:	kHz
Parameter Type:	Configurable
Group:	Input Config
Factory Default:	250.0 kHz
Minimum Value:	2.0 kHz
Maximum Value:	250.0 kHz

INPUT CONFIG

[Freq In Zero] — P.138

Only used if the I/O Expansion kit is installed.

Specifies the minimum input frequency. This is the frequency that corresponds to a value of zero. If the input frequency drops below the frequency specified by this input parameter, the resulting digital value remains zero (it will not go negative).

Display/Drive Units:	kHz
Parameter Type:	Configurable
Group:	Input Config
Factory Default:	2.0 kHz
Minimum Value:	2.0 kHz
Maximum Value:	250.0 kHz

OUTPUT CONFIG

[Anlg Out 1 Gain] — P.144

Scales the Analog Output Signal at the regulator board terminal strip.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Output Config
Factory Default:	1.00
Minimum Value:	0.100
Maximum Value:	1.900

OUTPUT CONFIG

[Anlg Out 1 Src] — P.145

Selects the drive testpoint that will source meter output 1 (terminals 24 and 25 on the regulator board).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Cur Lp Fdbk 1 = Cur Loop Ref 2 = Cur Loop Err 3 = Spd Loop Fdbk 4 = Spd Lp Ref 5 = Spd Lp Error 6 = Spd Lp Out 7 = Spd Ramp Out 8 = Spd Ramp In 9 = Spd Src Out 10 = Trim Output 11 = Arm Volt 12 = ATach Fdbk 13 = Encoder Fdbk 14 = Zero 15 = Full Scale 16 = Power Output 17 = OCL Ref 18 = OCL Ramp Out 19 = OCL Feedback 20 = OCL Output 21 = Field Ref 22 = Field Fdbk *Note: See Table A below for Full Scale Values*
Default Setting:	0 [Cur Lp Fdbk]
Minimum Value:	0 [Cur Lp Fdbk]
Maximum Value:	22 [Field Fdbk]
Parameter Type:	Tunable
Group:	Output — Output Config

Table A – Source Signal Values

Signal Selected	Full Scale Value
[Cur Loop Fdbk] — P.006 **[Cur Loop Ref] — P.008** **[Cur Loop Error] — P.007** **[Spd Loop Output] — P.024**	**[Motor Arm Amps (P.45)]** $\times \frac{\textbf{Maximum Current (P.40)}}{100}$ = FULL SCALE VALUE
[Spd Loop Fdbk] — P.022 **[Spd Loop Ref] — P.025** **[Spd Loop Error] — P.021** **[Spd Ramp Output] — P.028** **[Spd Ramp Input Tp] — P.027** **[Spd Sc Output] — P.026** **[Trim Output] — P.030** **[Analog Tach Fdbk] — P.194** **[Encoder Fdbk] — P.189** **[OCL Output] — P.018**	**Top Speed**
[Armature Voltage] — P.005	**[Motor Arm Volts]**
Power Output	**[Motor Arm Volts]** $\times$ **[Motor Arm Amps]** $\times \frac{\textbf{Maximum Current}}{100}$
[Fld Reference] — P.280 **[Field Feedback] — P.010**	**[Motor Field Amps]**
[OCL Reference TP] — P.020 **[OCL Ramp Output] — P.019** **[OCL Feedback] — P.017**	**4095**

OUTPUT CONFIG

[Anlg Out 1 Zero] — P.146

Removes any hardware-introduced offset from the Analog 1 output signal at the regulator board terminal strip.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Output Config
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

[Anlg Out 2 Gain] — P.147

Scales the Analog 2 Output Signal at the regulator board terminal strip.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Output Config
Factory Default:	1.000
Minimum Value:	0.100
Maximum Value:	1.900

OUTPUT CONFIG

[Anlg Out 2 Src] — P.148

Selects the drive testpoint that will source meter output 2 (terminals 25 and 26 on the regulator board).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Cur Lp Fdbk 1 = Cur Loop Ref 2 = Cur Loop Err 3 = Spd Loop Fdbk 4 = Spd Lp Ref 5 = Spd Lp Error 6 = Spd Lp Out 7 = Spd Ramp Out 8 = Spd Ramp In 9 = Spd Src Out 10 = Trim Output 11 = Arm Volt 12 = ATach Fdbk 13 = Encoder Fdbk 14 = Zero 15 = Full Scale 16 = Power Output 17 = OCL Ref 18 = OCL Ramp Out 19 = OCL Feedback 20 = OCL Output 21 = Field Ref 22 = Field Fdbk *Note: See Table A below for Full Scale Values*
Default Setting:	**[Spd Lp Fdbk]**
Parameter Type:	Tunable
Minimum Value:	0 [Cur Lp Feedback]
Maximum Value:	22 [Field Feedback]
Group:	Output Config

Table A – Source Signal Values

Signal Selected	Full Scale Value
[Cur Loop Fdbk] — P.006 **[Cur Loop Ref] — P.008** **[Cur Loop Error] — P.007** **[Spd Loop Output] — P.024**	**[Motor Arm Amps (P.45)]** $\times \frac{\textbf{Maximum Current (P.40)}}{100}$ = Full Scale Value
[Spd Loop Fdbk] — P.022 **[Spd Loop Ref] — P.025** **[Spd Loop Error] — P.021** **[Spd Ramp Output] — P.028** **[Spd Ramp Input Tp] — P.027** **[Spd Sc Output] — P.026** **[Trim Output] — P.030** **[Analog Tach Fdbk] — P.194** **[Encoder Fdbk] — P.189** **[OCL Output] — P.018**	**Top Speed**
[Armature Voltage] — P.005	**[Motor Arm Volts]**
Power Output	**[Motor Arm Volts]** $\times$ **[Motor Arm Amps]** $\times \frac{\textbf{Maximum Current}}{100}$
[Fld Reference] — P.280 **[Field Feedback] — P.010**	**[Motor Field Amps]**
[OCL Reference TP] — P.020 **[OCL Ramp Output] — P.019** **[OCL Feedback] — P.017**	**4095**

OUTPUT CONFIG

[Anlg Out 2 Zero] — P.149

Removes any hardware-introduced offset from the Analog 2 output signal at the regulator board terminal strip.

Display/Drive Units:	Numeric
Parameter Type:	Tunable
Group:	Output Config
Factory Default:	0
Minimum Value:	–200
Maximum Value:	200

[Anlg Out 3 Gain] — P.150

Only used if the I/O Expansion kit is installed.

Adjusts analog output 3 (terminals 54 and 55 on the I/O Expansion board) to allow it to produce a signal from 5.0 to approximately 13.0 VDC.

Display/Drive Units:	VDC
Parameter Type:	Tunable
Group:	Output Config
Factory Default:	1.00
Minimum Value:	0.500
Maximum Value:	1.300

This is typically used to adjust the 10 V full scale output to match the input voltage requirement of attached equipment. For example, this parameter would be set to 0.800 to match the requirements of equipment that accepts a 0 to 8 VDC signal.

The outputs are only rated to 10 VDC, so gain adjust values greater than 1.000 might cause the analog output circuit to saturate.

OUTPUT CONFIG

[Anlg Out 3 Src] — P.151

Only used if the I/O Expansion kit is installed.

Selects the signal used to drive analog output 3 (terminals 54 and 55 on the I/O Expansion board). When the analog output is at its maximum value, the selected signal is at its full scale value.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Cur Lp Fdbk 1 = Cur Loop Ref 2 = Cur Loop Err 3 = Spd Loop Fdbk 4 = Spd Lp Ref 5 = Spd Lp Error 6 = Spd Lp Out 7 = Spd Ramp Out 8 = Spd Ramp In 9 = Spd Src Out 10 = Trim Output 11 = Arm Volt 12 = ATach Fdbk 13 = Encoder Fdbk 14 = Zero 15 = Full Scale 16 = Power Output 17 = OCL Ref 18 = OCL Ramp Out 19 = OCL Feedback 20 = OCL Output 21 = Field Ref 22 = Field Fdbk *See Table A below for Full Scale Values*
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	0
Minimum Value:	0
Maximum Value:	22
Refer also to Parameters:	**[Maximum Current] — P.040** **[Motor Field Amps] — P.044** **[Motor Arm Amps] — P.045** **[Motor Arm Volts] — P.046** **[Max Motor Speed] — P.041**

Table A – Source Signal Values

Signal Selected	Full Scale Value
[Cur Loop Fdbk] — P.006 **[Cur Loop Ref] — P.008** **[Cur Loop Error] — P.007** **[Spd Loop Output] — P.024**	$\textbf{[Motor Arm Amps (P. 45)]} \times \frac{\textbf{Maximum Current (P. 40)}}{100}$ = Full Scale Value
[Spd Loop Fdbk] — P.022 **[Spd Loop Ref] — P.025** **[Spd Loop Error] — P.021** **[Spd Ramp Output] — P.028** **[Spd Ramp In TP] — P.027** **[Spd Src Output] — P.026** **[Trim Output] — P.030** **[Analog Tach Fdbk] — P.194** **[Encoder Fdbk] — P.189** **[OCL Output] — P.018**	**Top Speed**
[Armature Voltage] — P.005	**[Motor Arm Volts]**
Power Output	$\textbf{[Motor Arm Volts]} \times \textbf{[Motor Arm Amps]} \times \frac{\textbf{Maximum Current}}{100}$
[Fld Reference] — P.280 **[Field Feedback] — P.010**	**[Motor Field Amps]**
[OCL Reference TP] — P.020 **[OCL Ramp Output] — P.019** **[OCL Feedback] — P.017**	**4095**

OUTPUT CONFIG

[Anlg Out 3 Type] — P.152

Only used if the I/O Expansion kit is installed.

Selects the type of signal to be generated by analog output 3 (terminals 54 and 55 on the I/O Expansion board). This setting must match the settings of jumpers J14 and J15 on the I/O Expansion board.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = 0-10V 1 = ±10V 2 = 4-20mA 3 = 10–50mA
Default Setting:	±10V
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	1
Minimum Value:	0
Maximum Value:	3

[Anlg Out 4 Gain] — P.153

Adjusts analog output 4. Only used if I/O Expansion kit is installed.

Display/Drive Units:	VDC
Parameter Type:	Tunable
Group:	Output Config
Factory Default:	1.000
Minimum Value:	0.500
Maximum Value:	1.300

OUTPUT CONFIG

[Anlg Out 4 Src] — P.154

Only available if the I/O Expansion kit is installed.

Selects the signal used to drive analog output 4 (terminals 56 and 57 on the I/O Expansion board). When the analog output is at its maximum value, the selected signal is at its full scale value.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Cur Lp Fdbk 1 = Cur Loop Ref 2 = Cur Loop Err 3 = Spd Loop Fdbk 4 = Spd Lp Ref 5 = Spd Lp Error 6 = Spd Lp Out 7 = Spd Ramp Out 8 = Spd Ramp In 9 = Spd Src Out 10 = Trim Output 11 = Arm Volt 12 = ATach Fdbk 13 = Encoder Fdbk 14 = Zero 15 = Full Scale 16 = Power Output 17 = OCL Ref 18 = OCL Ramp Out 19 = OCL Feedback 20 = OCL Output 21 = Field Ref 22 = Field Fdbk *See Table A below for Full Scale Values*
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	0
Minimum Value:	0 [Cur Lp Fdbk]
Maximum Value:	22 [Field Fdbk]

Table A – Source Signal Values

Signal Selected	Full Scale Value
[Cur Loop Fdbk] — P.006 **[Cur Loop Ref] — P.008** **[Cur Loop Error] — P.007** **[Spd Loop Output] — P.024**	**[Motor Arm Amps (P. 45)]** $\times \frac{\textbf{(Maximum Current)P. 40)}}{100}$ = Full Scale Value
[Spd Loop Fdbk] — P.022 **[Spd Loop Ref] — P.025** **[Spd Loop Error] — P.021** **[Spd Ramp Output] — P.028** **[Spd Ramp In TP] — P.027** **[Spd Src Output] — P.026** **[Trim Output] — P.030** **[Analog Tach Fdbk] — P.194** **[Encoder Fdbk] — P.189** **[OCL Output] — P.018**	**Top Speed**
[Armature Voltage] — P.005	**[Motor Arm Volts]**
Power Output	**[Motor Arm Volts]** $\times$ **[Motor Arm Amps]** $\times \frac{\textbf{Maximum Current}}{100}$
[Fld Reference] — P.280 **[Field Feedback] — P.010**	**[Motor Field Amps]**
[OCL Reference TP] — P.020 **[OCL Ramp Output] — P.019** **[OCL Feedback] — P.017**	**4095**

OUTPUT CONFIG

[Dig Out 1 Src] — P.155

Only available if the I/O Expansion Kit is installed.

Selects the signal that drives digital output 1 (terminals 66 and 67 on the I/O Expansion board).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Monitor 1 Out 1 = Monitor 2 Out 2 = In Current Limit 3 = Drive Ready
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	0 [Monitor 1 Out]
Minimum Value:	0 [Monitor 1 Out]
Maximum Value:	3 [Drive Ready]

ATTENTION: This output is intended for use as an indication: DO NOT use this as a control source. If it is used as a control source, a dangerous condition can result. Failure to observe this precaution can result in severe bodily injury or loss of life.

[Dig Out 1 Type] — P.156

Only used if the I/O Expansion Kit is installed.

Selects whether digital output 1 (terminals 66 and 67 on I/O Expansion board) is normally open or normally closed.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Normal Open 1 = Normal Closed
Parameter Type:	Configurable
Group:	Output Configuration
Factory Default:	0 [Normal Open]
Minimum Value:	0 [Normal Open]
Maximum Value:	1 [Normal Closed]

ATTENTION: On a power cycle or reset, the contact is held at normally open until the drive software is initialized. Make sure that this condition does not result in a dangerous situation for your application. Failure to observe this precaution can result in severe bodily injury or loss of life.

If **[Normal Open]** is selected, digital output 1 is open when the signal is off and closed when it is on.

If **[Normal Closed]** is selected, digital output 1 is closed when the signal is off and open when it is on.

OUTPUT CONFIG

[Dig Out 2 Src] — P.157

Only used if the I/O Expansion Kit is installed.

Selects the signal used to drive digital output 2 (terminals 68 and 69 on the I/O Expansion board).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Monitor1 Out 1 = Monitor2 Out 2 = In Cur Limit 3 = Drive Ready
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	1
Minimum Value:	0
Maximum Value:	3

ATTENTION: This output is intended for use as an indication. DO NOT use this as a control source. If it is used as a control source, a dangerous condition can result. Failure to observe this precaution can result in severe bodily injury or loss of life.

[Dig Out 2 Type] — P.158

Only used if the I/O Expansion Kit is installed.

Selects whether digital output 2 (terminals 68 and 69 on I/O Expansion board) is normally open or normally closed.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Normal Open 1 = Normal Closed
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

ATTENTION: On a power cycle or reset, the contact is held at normally open until the drive software is initialized. Make sure that this condition does not result in a dangerous situation for your application. Failure to observe this precaution can result in severe bodily injury or loss of life.

If **[Normal Open]** is selected, digital output 2 is open when the signal is off and closed when it is on.

If **[Normal Closed]** is selected, digital output 2 is closed when the signal is off and open when it is on.

[Freq Out Scale] — P.159

Only used if the I/O Expansion kit is installed.

The frequency generated when the signal driving the frequency output is at full scale.

For example, if **[Freq Out Source]** is set to **[Cur Lp Fdbk]**, the frequency specified by this parameter is output when the armature current is at **[Maximum Current]** — **[Maximum Current]** is used as the basis for current minor loop scaling.

Display/Drive Units:	kHz
Parameter Type:	Configurable
Group:	Output Config.
Factory Default:	250.0 kHz
Minimum Value:	2.0 kHz
Maximum Value:	250.0 kHz
Refererence Parameters:	**[Freq Out Source] — P.160** **[Maximum Current] — P.040**

OUTPUT CONFIG

[Freq Out Source] — P.160

Only used if the I/O Expansion kit is installed.

Selects the signal that drives the frequency output (terminals 42, 43, and 44 on the I/O Expansion board). When the frequency output is at its maximum value, the selected signal is at its full scale value.

Display/Drive Units:	Numeric/Text	
Parameter Range:	0 = Cur Lp Fdbk	11 = Arm Volt
	1 = Cur Loop Ref	12 = ATach Fdbk
	2 = Cur Loop Err	13 = Encoder Fdbk
	3 = Spd Loop Fdbk	14 = Zero
	4 = Spd Lp Ref	15 = Full Scale
	5 = Spd Lp Error	16 = Power Output
	6 = Spd Lp Out	17 = OCL Ref
	7 = Spd Ramp Out	18 = OCL Ramp Out
	8 = Spd Ramp In	19 = OCL Feedback
	9 = Spd Src Out	20 = OCL Output
	10 = Trim Output	21 = Field Ref
		22 = Field Fdbk
Parameter Type:	Configurable	
Group:	Output Config	
Factory Default:	14 (Zero)	
Minimum Value:	0	
Maximum Value:	22	

Signal Selected	Full Scale Value
[Cur Loop Fdbk] — P.006 **[Cur Loop Ref] — P.008** **[Cur Loop Error] — P.007** **[Spd Loop Output] — P.024**	**[Motor Arm Amps]** $\times \frac{\textbf{Maximum Current}}{100}$
[Spd Loop Fdbk] — P.022 **[Spd Loop Ref] — P.025** **[Spd Loop Error] — P.021** **[Spd Ramp Output] — P.028** **[Spd Ramp Input Tp] — P.027** **[Spd Sc Output] — P.026** **[Trim Output] — P.030** **[Analog Tach Fdbk] — P.194** **[Encoder Fdbk] — P.189** **[OCL Output] — P.018**	Top Speed
[Armature Voltage] — P.005	**[Motor Arm Volts]**
Power Output	**[Motor Arm Volts]** $\times$ **[Motor Arm Amps]** $\times \frac{\textbf{Maximum Current}}{100}$
[Fld Reference] — P.280 **[Field Feedback] — P.010**	**[Motor Field Amps]**
[OCL Reference TP] — P.020 **[OCL Ramp Output] — P.019** **[OCL Feedback] — P.017** Full Scale	4095
Zero	0

OUTPUT CONFIG

[Freq Out Zero] — P.161

Only used if the I/O Expansion kit is installed.

The frequency generated when the signal driving the frequency output is zero. If the signal goes negative, the frequency output maintains the frequency set by this parameter.

Display/Drive Units:	kHz
Parameter Range:	2.0 to 250.0 kHz
Parameter Type:	Configurable
Group:	Output Config
Factory Default:	2.0 kHz
Minimum Value:	2.0 kHz
Maximum Value:	250.0 kHz

DIAGNOSTICS

[Last Stop Cause] — P.166

Identifies the source of the signal which caused the most recent drive “stop”.

This parameter is Read Only

Display/Drive Units:	Numeric / Text	
Parameter Range:	Bit #	Enum Text
	0	External
	1	Jog
	2	Internal
	3	Current Limit
	4	Ramp
	5	Coast
	6,7	Not Used
	8	Fault
	9	TB Interlock
	10	TB Coast / OB
	11	M–Contactor
	12–15	Not Used
Parameter Type:	Configurable	
Group:	Diagnostics	
Factory Default:	N/A	
Minimum Value:	N/A	
Maximum Value:	N/A	

[Open SCR Sens] — P.167

Open SCR diagnostic sensitivity adjustment. Unbalanced AC lines can cause load sharing differences between SCRs. This parameter should be increased to increase the tolerance of SCR load sharing differences due to unbalanced lines.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Diagnostics
Factory Default:	0%
Minimum Value:	0%
Maximum Value:	100%

DIAGNOSTICS

[Open SCR Trip Pt] — P.168

Open SCR trip threshold. Extremely unusual load conditions or severe current loop instability can cause nuisance open SCR faults. Increasing this input will increase the tolerance of such disturbances.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Diagnostics
Factory Default:	800
Minimum Value:	800
Maximum Value:	4000

[Phase Tst Delta] — P.169 FACTORY TEST PARAMETER, NOT FOR CUSTOMER USE

The test firing conduction angle of the SCRs. If equal to 0, the armature power bridge is off. If it is set to 180, the armature power bridge is fully on.

Display/Drive Units:	Degree
Parameter Type:	Tunable
Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	180

ATTENTION: The armature phase fire test is unregulated. To prevent excess motor speed, either disconnect the armature leads from the drive and replace with a similar load or disconnect the field leads from the drive. Lock the motor armature shaft securely to prevent rotation in either direction prior to selecting this test.

[Phase Tst Bridge] — P.170 FACTORY TEST PARAMETER, NOT FOR CUSTOMER USE

Selects which armature bridge (forward or reverse) is used during the phase fire test. This input can only be changed while the drive is stopped.
OFF selects the forward bridge (A1 positive with respect to A2). ON selects the reverse bridge (A1 negative with respect to A2).

Display/Drive Units:	Selection
Parameter Type:	Tunable
Group:	Diagnostics
Factory Default:	Forward
Minimum Value:	Forward (Off)
Maximum Value:	Reverse (On)

[Armature Bridge] — P.171

Shows which armature bridge in the drive is currently active.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Forward 1 = Reverse
Parameter Type:	Output
Group:	Diagnostics
Factory Default:	0 (Forward)
Minimum Value:	0 (Forward)
Maximum Value:	1 (Reverse)

DIAGNOSTICS

[Armature Delta] — P.172

Shows the actual firing angle (in µs).

Display/Drive Units:	uSEC
Parameter Type:	Output
Group:	Diagnostics
Factory Default:	0
Minimum Value:	–6480
Maximum Value:	6480

[Cur Compound TP] — P.173

An output testpoint that represents the current compounding value being used by the drive.

Display/Drive Units:	RPM
Parameter Type:	N/A
Group:	Diagnostics
Factory Default:	0
Minimum Value:	–4095
Maximum Value:	4095

[Field Delta] — P.174

The firing angle of the output of the field current regulator to the regulated field supply gate firing circuit. Output of the field current PI block.

Display/Drive Units:	DEG
Group:	Diagnostics
Parameter Type:	Read Only
Factory Default:	0
Minimum Value:	–5400
Maximum Value:	5400

[Fld Econ Active] — P.175

Indicates the present state of field economy mode.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Not Active 1 = Active
Parameter Type:	Read Only
Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

DIAGNOSTICS

[Field Ref TP] — P.176

Field current reference testpoint. It is the limited value of **[Field Reference]** or the field economy reference — when **[Field Econ Active]** is On. Refer to the **Field Control Loop** (Dia A.10) block diagram for additional information.

Display/Drive Units:	AMPS
Parameter Range:	N/A
Group:	Diagnostics
Factory Default:	0
Minimum Value:	-0.1
Maximum Value:	15 Based on field regulator installed

[Field Regulator] — P.177

Indicates whether or not the Field Current Regulator kit is installed. If it is installed, lists the rating of the kit that is installed.

Display/Drive Units:	ENUM
Group:	Diagnostics
Parameter Range:	Not Installed 4 Amp 10 Amp 20 Amp
Factory Default:	n/a
Minimum Value:	Not Installed
Maximum Value:	20 Amp

[Expansion I/O] — P.178

Indicates whether or not the I/O Expansion kit is installed in the drive and if it has passed diagnostics. If the I/O Expansion Kit has failed diagnostics, the drive is not operable (the armature cannot become active).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Not Installed 1 = Installed 2 = Failed Diags 3 = Failed Diags
Group:	Diagnostics
Factory Default:	0 [Not Installed]
Minimum Value:	0 [Not Installed]
Maximum Value:	3 [Failed Diagnostics]

[IR Comp TP] — P.179

An output testpoint that represents the level of **[IR Comp]** being used by the drive. This parameter only has meaning if the selected drive feedback is set to armature voltage.

Display/Drive Units:	VOLT
Group:	Diagnostics
Type:	Output
Factory Default:	0
Minimum Value:	0
Maximum Value:	338.0

DIAGNOSTICS

[J11 Tach V Scale] — P.180

Position in which to set J11 hardware jumper based on the values of **[Max Motor Speed]** and **[Anlg Tach V/1000]**.
This is a READ ONLY parameter. Set Jumper J11 to the drive determined value that is displayed.

Display/Drive Units:	Numeric/Text
Parameter Range:	Low, High
Group:	Diagnostics Read Only
Factory Default:	0
Minimum Value:	–1920
Maximum Value:	1920

[J14 Tach V Range] — P.181

Position in which to set J14 hardware jumper based on the values of [Top Speed] and [Analog Tach V/1000].
This is a READ ONLY parameter. Set Jumper J14 to the drive determined value that is displayed.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Low 1 = High
Group:	Diagnostics Read Only
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

ATTENTION: The drive will not operate at the correct speed if this jumper is not set to the correct position. Failure to observe this precaution could result in damage to, or destruction of the equipment.

[J15 Reg Type] — P.182

Indicates the position of hardware jumper J15 Regulator Type, which selects the type of regulator: Speed/Voltage or Current/Torque. This jumper is only read at power-up.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Spd/Voltage 1 = Curr/Torque
Group:	Diagnostics Read Only
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

[J18 Arm Fdbk Res] — P.183

Indicates the required burden resistor position to scale armature current feedback based on the values of **[CT Turns Ratio]**, **[Maximum Current]** and **[Motor Arm Amps]**.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = J18 Error 1 = Position 1 2 = Position 2 3 = Position 3 4 = Position 4
Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	4

DIAGNOSTICS

[J20 Fld Loss Det] — P.184

Indicates the position of hardware jumper Field Loss Detect, which enables or disables field current loss detection. This jumper is only read on powerup.
This jumper is not used if a field current regulator is installed.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Enabled 1 = Disabled
Parameter Type:	Tunable
Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

ATTENTION: Disabling field loss detection can allow the motor to run with no or low field voltage which can result in high motor speed. Failure to observe this precaution could result in severe bodily injury or loss of life.

[J21 Field Supply] — P.185

Indicates the position of hardware jumper Field Supply Jumper, which must be set according to the jumper of the Enhanced Field Supply — positions A-C or B-C.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = B-C 1 = A-C
Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

This jumper only applies to the Enhanced Field Supply and does not effect the operation of the standard or current regulator field supplies. This jumper is only read on power-up.

This parameter is not available if a Field Regulator Supply Kit is installed.

[Power Unit Type] — P.186

Indicates if the drives employs an S6R (regenerative) or an S6 (non-regenerative) power unit. If the power unit type is S6 (non-regenerative), **[Neg Current Lim]** will be automatically fixed to 0, and **[Reverse Disable]** fixed to On (preventing reverse direction).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = S6R (Regen) 1 = S6 (Non–Rgn)
Group:	Diagnostics Read Only
Factory Default:	0
Minimum Value:	0
Maximum Value:	1

DIAGNOSTICS

[Encoder Kit] — P.187

Indicates the presence of an encoder kit.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Not Installed 1 = Installed 2 = Failed Diags
Group:	Diagnostics
Parameter Type:	Read Only
Factory Default:	0
Minimum Value:	0
Maximum Value:	2

[Regulator SW Ver] — P.188

Shows software version # of the regulator.

Display/Drive Units:	Numeric/Text
Parameter Type:	Read Only
Group:	Diagnostics
Factory Default:	1.0x
Minimum Value:	1.04
Maximum Value:	1.xx

[Encoder Fdbk] — P.189

The digital value from the encoder after all hardware and software scaling. For use with pulse tachometer feedback only.

Display/Drive Units:	RPM
Group:	Diagnostics
Parameter Type:	Read Only
Factory Default:	0
Minimum Value:	–4001
Maximum Value:	4001

DIAGNOSTICS

[Logic Status] — P.190

Displays the logic condition. A typical value at power up would be 0000000000000101 (i.e. drive is ready, not running, forward direction commanded, no accel/decel, no alarm, no fault etc.).

Bit	Definition	Status
0	Enabled	1=Enabled
1	Running	1=Running
2	Command Dir	1=Forward
3	Actual Direction	1=Forward
4	Acceleration	1=Accelerating
5	Deceleration	1=Decelerating
6	Warning	1=Warning
7	Fault	1=Faulted
8	At Ref (speed)	1=At Ref.
9–11	Local #	
12–15	Reference *	

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Enabled
	1 = Running
	2 = Command Dir
	3 = Actual Dir
	4 = Accelerating
	5 = Decelerating
	6 = Alarm
	7 = Faulted
	8 = At Speed
	9 = Local ID
	Bit# Enum Text
	10 = Local ID
	11 = Local ID
	12–15 = Reference ID

Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	15

#

000 = Port 0 local
001 = Port 1 local
010 = Port 2 local
011 = Port 3 local
100 = Port 4 local
110 = Port 5 local
111 = Multiplexed

*****

0000 = Master Ext Ref 1
0001 = Int Ref 1 (Preset 1)
0010 = Int Ref 2 (Preset 2)
0011 = Int Ref 3 (Preset 3)
0100 = Int Ref 4 (Preset 4)
0101 = Int Ref 5 (Preset 5)
0110 = Int Ref 6 (Preset 6)
0111 = Int Ref 7 (Preset 7)
1000 = Master Ext Ref 2
1001 = Port 1 Ext Ref
1010 = Port 2 Ext Ref
1011 = Port 3 Ext Ref
1100 = Port 4 Ext Ref
1101 = Port 5 Ext Ref
1110 = Port 6 Ext Ref
1111 = Int Jog

[Drive Status] — P.191

This parameter displays the actual operating condition in text format

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Not Ready 1 = Ready 2 = Running 3 = Jogging 4 = Tuning 5 = Stopping 6 = Faulted
Group:	Diagnostics
Factory Default:	0
Minimum Value:	0
Maximum Value:	6

[AC Line Period] — P.192

Shows AC line as measured by the drive.

Display/Drive Units:	uSEC
Parameter Type:	Read Only
Group:	Diagnostics
Factory Default:	None
Minimum Value:	16,124
Maximum Value:	20833

DIAGNOSTICS

[AC Line Voltage] — P.193

Shows AC line voltage as measured by the drive.

Display/Drive Units:	VAC
Parameter Type:	Read Only
Group:	Diagnostics
Factory Default:	None
Minimum Value:	200
Maximum Value:	575

[Analog Tach Fdbk] — P.194

The digital value of the analog tachometer feedback input after all hardware and software scaling. For use with analog tachometer feedback (AC or DC) only.

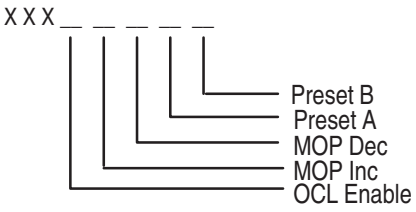
Display/Drive Units:	RPM
Parameter Range:	N/A
Parameter Type:	Output
Group:	Diagnostics
Factory Default:	0
Minimum Value:	–4095
Maximum Value:	4095

[Exp I/O Dig In] — P.195

Only used if the I/O Expansion kit is installed.

Shows the state of all I/O expansion digital inputs (terminals 59–64 on the I/O Expansion board). The input is On when +24 V DC is applied for more than 20 mS. It is Off when 0 V DC is applied. Information is displayed in binary format.

Display/Drive Units:	Numeric/Text	
Parameter Range:	Bit # Enum Text	Bit # Enum Text
	0 = Preset A	3 = Increment
	1 = Preset B	4 = OCL Enable
	2 = Decrement	
Factory Default:	0	
Minimum Value:	0	
Maximum Value:	4	



[Fault Reset] — P.196

Allows resetting of the fault or alarm through the HIM.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Ready 1 = Reset
Group:	Diagnostics
Minimum Value:	0
Factory Default:	0
Maximum Value:	1

DIAGNOSTICS

[Alarm Reset] — P.197

Allows resetting of the fault or alarm through the HIM.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Ready 1 = Reset
Parameter Type:	Read Only
Group:	Diagnostics
Minimum Value:	0
Factory Default:	0
Maximum Value:	1

Note: Analog input 2 (terminals 52 and 53 on the I/O Expansion board) only accepts a ±10 VDC input signal and cannot be changed.

[CPU Loading] — P.198

Shows the amount in % that the CPU is busy. Should always display 100%.

Display/Drive Units:	%
Parameter Type:	Read Only
Group:	Diagnostics
Minimum Value:	0
Factory Default:	0
Maximum Value:	100

[Not Ready Cause] — P.199

Shows those inputs or conditions that cause the Drive to remain “Not Ready”.

Bit#	Enum
0	Stop Asserted
1	TB Coast/DB
2	TB Interlock
3	Fault Active
4	Config Active
5	Field Perm

Display/Drive Units:	Numeric/Text
Parameter Type:	Read Only
Group:	Diagnostics
Minimum Value:	0
Maximum Value:	5

[ScanPort Errors] — P.200

The value of this parameter is incremented everytime a SCANport message is not received when expected from a peripheral device. This value incrementing occasionaly does not indicate a problem. The value will change, if SCANport devices are removed or reconnected to the drive. A value that is consistently incrementing, over a period of time, indicates a possible electrical noise problem or malfunctioning peripheral SCANport device.

Display/Drive Units:	%
Parameter Type:	Read Only
Group:	Diagnostics
Minimum Value:	0
Factory Default:	0
Maximum Value:	6500

MASKS

[Start Mask] — P.201

This parameter controls which adapters can issue Run commands.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read & Write
Group:	Masks
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

[Direction Mask] — P.202

This parameter controls which adapters can issue forward/reverse commands. This mask contains a bit for each adapter. If a bit is set to 0 control is locked out, if it is set to 1, the adapter is permitted to have control.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Group:	Masks
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

[Jog Mask] — P.203

This parameter controls which adapters can issue jog commands.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read & Write
Group:	Masks
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

MASKS

[Reference Mask] — P.204

This parameter controls which adapters can select an alternate reference.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read & Write
Group:	Masks
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

[Fault Reset Mask] — P.205

This parameter controls which adapters can reset a fault condition.

Display/Drive Units:	
Parameter Type:	Read & Write
Group:	Masks
Minimum Value:	000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

[MOP Mask] — P.206

This parameter controls which adapters can issue MOP commands to the drive

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Group:	Masks
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

MASKS

[Logic Mask] — P.207

This parameter determines which adapters can control the drive. If the bit for an adapter is set to "0", the adapter will have no control functions except for stop. In addition, the adapter can be removed from the drive while power is applied without causing a serial fault.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Tunable
Group:	Masks or through Control Logic
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

[Local Mask] — P.208

This parameter controls which adapters are allowed to take exclusive control of drive logic commands (except stop). Exclusive "Local Control" can only be taken while the drive is stopped.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read & Write
Group:	Masks
Minimum Value:	0000000000000000
Factory Default:	0000000001111111
Maximum Value:	0000000001111111

OWNERS

[Stop Owner] — P.214

This parameter displays which adapters are presently issuing a valid stop command.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

[Start Owner] — P.215

This parameter displays which adapters are presently issuing a valid run command.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

[Direction Owner] — P.216

This parameter displays which adapter currently has exclusive control of direction changes.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

OWNERS

[Jog Owner] — P.217

This parameter displays which adapters are presently issuing a valid jog command.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

[Reference Owner] — P.218

Shows current reference owner.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

OWNERS

[Flt Reset Owner] — P.219

This parameter displays which parameter is currently resetting a fault.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

[MOP Owner] — P.220

This parameter displays which adapters are currently issuing increases or decreases in MOP Command Frequency.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

[Local Owner] — P.221

This parameter displays which adapter has requested exclusive control of all drive logic functions. If an adapter is in local lockout, all other functions (except stop) on all other adapters are locked out and non–functional. Local control can only be obtained when the drive is not running.

Display/Drive Units:	Numeric/Text

Parameter Range:	Bit # Enum Text
	0 = Terminal Block
	1 = Adapter 1
	2 = Adapter 2
	3 = Adapter 3
	4 = Adapter 4
	5 = Adapter 5
	6 = Adapter 6

Parameter Type:	Read Only
Group:	Owners
Minimum Value:	0000000000000000
Factory Default:	0000000000000000
Maximum Value:	0000000001111111

Adapter I/O

[Data In A1] — P.226

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data In A2] — P.227

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data In B1] — P.228

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data In B2] — P.229

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

Adapter I/O

[Data In C1] — P.230

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data In C2] — P.231

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data In D1] — P.232

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data In D2] — P.233

This parameter displays the parameter number to which PLC output data table information will be directly written during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

Adapter I/O

[Data Out A1] — P.234

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data Out A2] — P.235

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data Out B1] — P.236

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data Out B2] — P.237

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

Adapter I/O

[Data Out C1] — P.238

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data Out C2] — P.239

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data Out D1] — P.240

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

[Data Out D2] — P.241

This parameter displays the parameter number whose value will be written into the PLC input data table during PLC operation.

Display/Drive Units:	Numeric/Text
Group:	Adapter I/O
Type:	Configurable
Minimum Value:	0
Factory Default:	0
Maximum Value:	308

Process Display

[Process 1 Par] — P.247

This parameter should be set to the number of the parameter whose scaled value will be displayed on Line 1 of the HIM Display Panel.

Display/Drive Units:	Numeric/Text
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	0
Factory Default:	5
Maximum Value:	308

[Process 1 Scale] — P.248

This value sets the scaling multiplier for [Process 1 Par].

Display/Drive Units:	Numeric/Text
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	–32768
Factory Default:	1.00
Maximum Value:	32767

[Process 1 Text 1] — P.249

Sets the “User Units” description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	86
Maximum Value:	127

[Process 1 Text 2] — P.250

Sets the “User Units” description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	111
Maximum Value:	127

Process Display

[Process 1 Text 3] — P.251

Sets the "User Units" description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	108
Maximum Value:	127

[Process 1 Text 4] — P.252

Sets the "User Units" description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	116
Maximum Value:	127

[Process 1 Text 5] — P.253

Sets the "User Units" description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	115
Maximum Value:	127

[Process 1 Text 6] — P.254

Sets the "User Units" description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value:	127

Process Display

[Process 1 Text 7] — P.255

Sets the "User Units" description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value:	127

[Process 1 Text 8] — P.256

Sets the "User Units" description for the value determined by [Process 1 Par] and [Process 1 Scale]. The 8 character description will be shown on line 1 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value:	127

[Process 2 Par] — P.257

This parameter should be set to the number of the parameter whose scaled value will be displayed on Line 2 of the HIM Display Panel.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	0
Factory Default:	6
Maximum Value:	308

[Process 2 Scale] — P.258

This value sets the scaling multiplier for [Process 2 Par].

Display/Drive Units:	Numeric/Text
Parameter Range:	–3127.69 – +327.68
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	–32768
Factory Default:	100
Maximum Value	32767

Process Display

[Process 2 Text 1] — P.259

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	65
Maximum Value	127

[Process 2 Text 2] — P.260

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	109
Maximum Value	127

[Process 2 Text 3] — P.261

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	112
Maximum Value	127

[Process 2 Text 4] — P.262

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	115
Maximum Value	127

Process Display

[Process 2 Text 5] — P.263

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value	127

[Process 2 Text 6] — P.264

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value	127

[Process 2 Text 7] — P.265

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value	127

[Process 2 Text 8] — P.266

Sets the "User Units" description for the value determined by [Process 2 Par] and [Process 2 Scale]. The 8 character description will be shown on line 2 of the display.

Display/Drive Units:	Numeric/Text
Parameter Range:	Alphanumeric
Parameter Type:	Read & Write
Group:	Process Display
Minimum Value:	32
Factory Default:	32
Maximum Value	127

Field

[E–Fld Volts Adj] — P.272

Only used if enhanced field supply option is installed.
Adjusts the field output voltage.

Display/Drive Units:	Degrees
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0
Factory Default:	84
Maximum Value	180

[Fld Econ Delay] — P.273

After the motor stops, the drive maintains full field for **[Field Econ Delay]** minutes before entering field economy. When the motor starts again, the drive immediately returns to full field. **[Field Econ Delay]** has no effect on the operation of the standard field supply. Field economy cannot be disabled.

Display/Drive Units:	Minutes
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0
Factory Default:	5
Maximum Value	27

[Fld Econ Ref] — P.274

Only available if the Field Current Regulator kit is installed.
The percentage of MOTOR FIELD AMPS (P.510) set as a reference for field economy mode. This parameter must be set above the FIELD LOSS THRESHOLD (P.512) value to avoid field loss faults.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0
Factory Default:	70
Maximum Value	100

Field

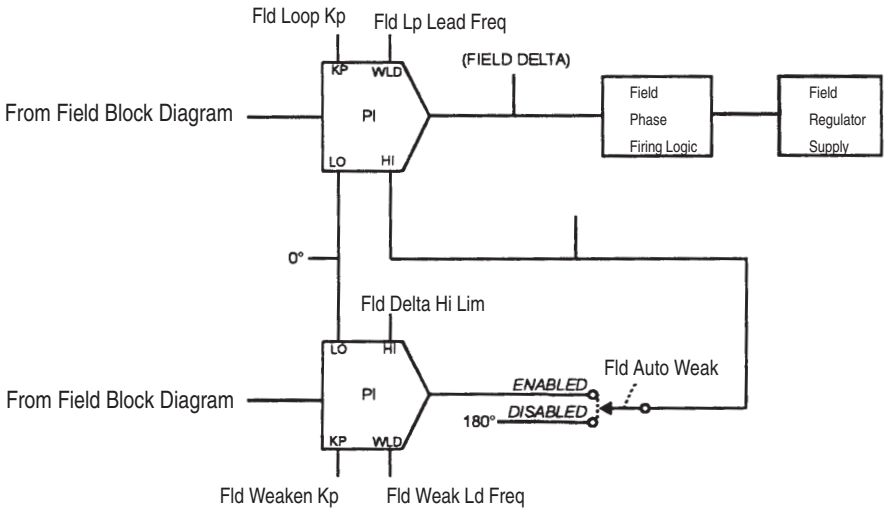
[Fld Auto Weak] — P.275

Only used if the Field Current Regulator Kit is installed.

Enables or disables field weakening by the field control loop. When it is disabled, the field current PI block high limit is fixed at 180°. If **[Feedback Select]** is set to **[Armature Volt]**, this is automatically set to **[Disabled]** and cannot be changed.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Disabled 1 = Enabled
Parameter Type:	Configurable
Group:	Field
Minimum Value:	0
Factory Default:	0
Maximum Value	1

When **[Armature Voltage]** exceeds **[Fld Weaken Level]** and the field begins to weaken, the field control loop regulates armature voltage. **[Armature Voltage]** and **[Fld Weaken Level]** try to maintain a zero input to the first PI block. If armature voltage increases, a negative value is input to the PI block. This results in a lower current input into the next PI block. This in turn lowers the armature voltage, lowering the input to the first PI block so that it is closer to zero. The field control loop only affects armature voltage control if a tachometer is used and if **[Field Auto Weak]** is set to **[Enabled]**.



[Fld Delta Hi Lim] — P.276

High limit of the field current PI block. See **[Field Auto Weak]** for block diagram.

Display/Drive Units:	Degrees
Parameter Type:	Configurable
Group:	Field
Minimum Value:	0
Factory Default:	130
Maximum Value	180

Field

[Fld Loss Level] — P.277

Only used if the Field Current Regulator Kit is installed.

The value that is compared to **[Field Feedback]** to check for field loss. **[Fld Loss Level]** is set as a percentage of **[Motor Field Amps]**. It is usually set to 85% of the motor nameplate value of field weaken.

Refer to **[Field Econ Ref]** for additional information.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0%
Factory Default:	60%
Maximum Value	100%

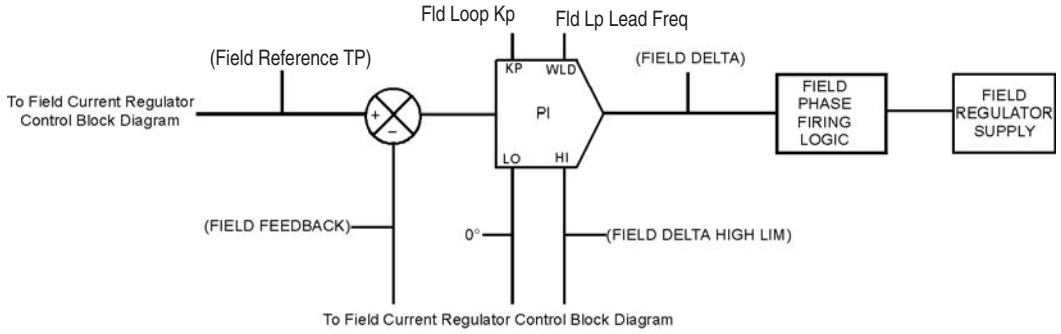
ATTENTION: The incorrect setting of this parameter can cause a motor overvoltage condition. Set **[Motor Fld Amps]** to the motor's nameplate value. Make sure **[Field Economy Ref]** and/or **[Field Ref] — P.280** is set greater than **[Field Loss Level] — P.277** to avoid field loss faults. Failure to observe this precaution can result in bodily injury and damage to the equipment.

[Fld Lp Lead Freq] — P.278

Only used if the Field Current Regulator Kit is installed.

Lead frequency for the field current PI block.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0
Factory Default:	10.0
Maximum Value	282.7



[Fld Loop Kp] — P.279

Only available if the Field Current Regulator kit is installed.

Proportional gain setting for the field current PI block.

Refer to the **Field Control Loop (Fig. A.10)** block diagram for additional information.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0.01
Factory Default:	0.30
Maximum Value	128.0

Field

[Field Reference] — P.280

Only used if the Field Current Regulator kit is installed.

Current reference for the field control loop field. This is the field current reference when the drive is not in field economy. Refer to the **[Motor Field Amps]** block diagram for additional information.

Display/Drive Units:	AMPS
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0.00
Factory Default:	0.00
Maximum Value	128.0

[Fld Loop K–Fdbk] — P.281

Only used if the Field Current Regulator kit is installed.

Gain adjustment for the field feedback. Refer to the **[Motor Field Amps]** block diagram for additional information.

In most cases, this will be set for unity gain, typically 1.000.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0.90
Factory Default:	1.00
Maximum Value	1.100

[Fld Weak Ld Freq] — P.282

Only used if the Field Current Regulator kit is installed.

PI block lead frequency of the field control loop's armature voltage regulator. Refer to the **[Field Auto Weak]** block diagram for additional information.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0.00 rad/sec
Factory Default:	0.30 rad/sec
Maximum Value	282.7 rad/sec

[Fld Weaken Kp] — P.283

Only used if the Field Current Regulator kit is installed.

The proportional gain of the field control loop's armature voltage regulator. Refer to the **[Field Auto Weak]** block diagram for additional information.

Parameter Type:	Tunable
Group:	Field
Minimum Value:	0.10
Factory Default:	0.80
Maximum Value	128.00

[Fld Weaken Level] — P.284

Only available if the Field Current Regulator kit is installed.

Sets the point at which the field control loop begins regulating armature voltage and the field begins to weaken. If IR compensation is used, the threshold is **[Fld Weaken Level]** less **[IR Compensation]** at rated armature current. Refer to the **Field Auto Weak** block diagram for additional information.

Display/Drive Units:	VOLT
Parameter Type:	Tunable
Group:	Field
Minimum Value:	0
Factory Default:	**228**
Maximum Value	4095 (4095 corresponds to MOTOR RATED ARM VOLTS)

Process PI

[OCL Fdbk Source] — P.290

Selects whether the outer control loop (OCL) feedback signal is obtained from an I/O Expansion kit analog input or from an eight-sample average of the current minor loop (CML) feedback signal.

Selecting **[Cur Lp Fdbk]** allows an outer current loop to be implemented.

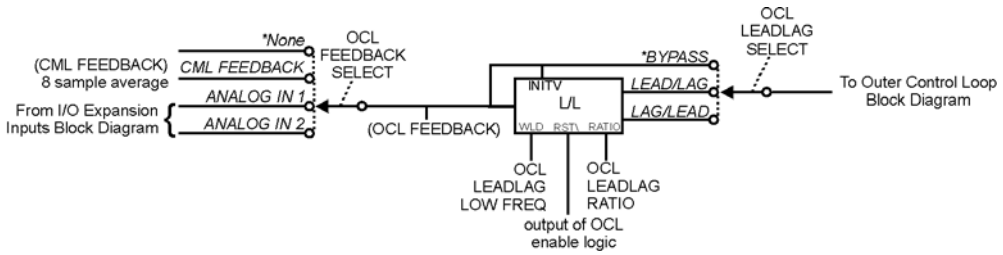
Display/Drive Units:	Numeric/Text
Parameter Range:	0 = None 1 = Cur Lp Fdbk 2 = Analog In 3 3 = Analog In 4 4 = Frequency In 5 = Adapter 1 6 = Adapter 2 7 = Adapter 3 8 = Adapter 4 9 = Adapter 5 10 = Adapter 6
Default Setting:	
Parameter Type:	Configurable
Group:	Process PI
Minimum Value:	0
Factory Default:	1 (Cur Lp Fdbk)
Maximum Value	10

[OCL LeadLag Freq] — P.291

Lead/lag low break frequency of the outer control loop. Sets the lead break frequency if **[OCL LeadLag Type]** is set to Lead/Lag. Sets the lag break frequency if **[OCL LeadLag Type]** is set to Lag/Lead.

Display/Drive Units:	RD/S
Parameter Type:	Tunable
Group	Process PI
Minimum Value:	0.01 rad/sec
Factory Default:	1.00 rad/sec.
Maximum Value	6.98 rad/sec

The OCL lead/lag high break frequency is determined by the settings of this parameter and the **[OCL Leadlag Rato]**. For example, if the low break frequency is 0.50 rad/sec and the ratio is 10, the high break frequency is 5.00 rad/sec.



Process PI

[OCL LeadLag Ratio] — P.292

The ratio between the low break frequency and high break frequency of outer control loop lead/lag. The settings of this parameter and the **[OCL LeadLag Freq]** determine the high break frequency.

Refer to the **[OCL LeadLag Freq]** parameter and block diagram for additional information.

Display/Drive Units:	Numeric/Text
Parameter Range:	2 to 20
Default Setting:	10
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	2
Factory Default:	10
Maximum Value	20

[OCL LeadLag Type] — P.293

Selects the outer control loop as lead/lag, lag/lead, or bypassed.

If the OCL is configured as a type 1 position regulator, this should be set to Bypass. For a type 2 position regulator, the lead/lag block can be used if necessary

Refer to the **[OCL Lead/Lag Freq]** parameter and block diagram for additional information.

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Lead/Lag 1 = Bypass 2 = Lag/Lead
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0
Factory Default:	1
Maximum Value	2

[OCL Kp] — P.294

The proportional gain of the outer control loop PI block. Refer to the **[OCL Lead Freq]** block diagram for additional information.

Display/Drive Units:	
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0.10
Factory Default:	2.0
Maximum Value	128.00

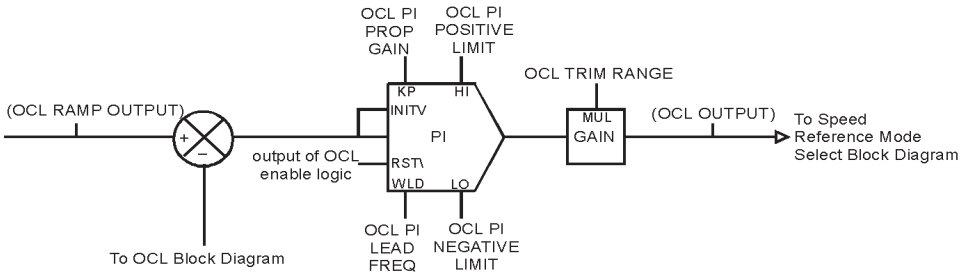
Process PI

[OCL Lead Freq] — P.295

The lead break frequency of the proportional integral (PI) block of the outer control loop.

If the OCL is configured as a type 1 position regulator, set equal to 0.00 (proportional only).

Display/Drive Units:	RD/S
Parameter Range:	0.00 to 141.37 rad/sec
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0.00
Factory Default:	1.00 rad/sec
Maximum Value	141.37 rad/sec



[OCL Pos Limit] — P.296

Outer Control Loop PI block positive limit. The output of OCL PI block is never above this limit. Refer to the **[Outer Control Loop]** block diagram (Fig. A.5) for additional information.

Display/Drive Units:	% of Max Motor Speed
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0.00 %
Factory Default:	100%
Maximum Value	100%

[OCL Neg Limit] — P.297

The negative limit of the outer control loop PI block. The output of the OCL PI block is never below this limit. Refer to the **[Outer Control Loop]** block diagram (Fig. A.5) for additional information.

Display/Drive Units:	% of Max Motor Speed
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0.00 %
Factory Default:	100%
Maximum Value	100%

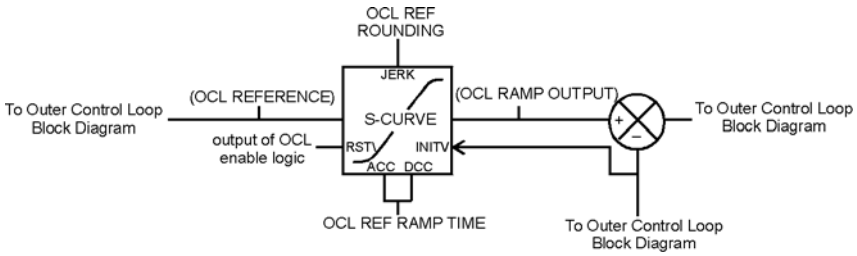
Process PI

[OCL Ramp Time] — P.298

The ramp time for the outer control loop reference. Sets the minimum amount of time for the OCL S-curve output to change from 0 to full scale and vice versa. If set to 0.0, the ramp block is bypassed.

Note: If the ramp block is bypassed, rapid speed change can result.

Display/Drive Units:	SEC
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0.0 sec.
Factory Default:	10.0 sec.
Maximum Value	300.0 sec.



[OCL Reference] — P.299

The reference value for the outer control loop. Displayed in OCL user units.

Display/Drive Units:	CNTS
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	–4095
Factory Default:	0
Maximum Value	4095

Process PI

[OCL Ref Rounding] — P.300

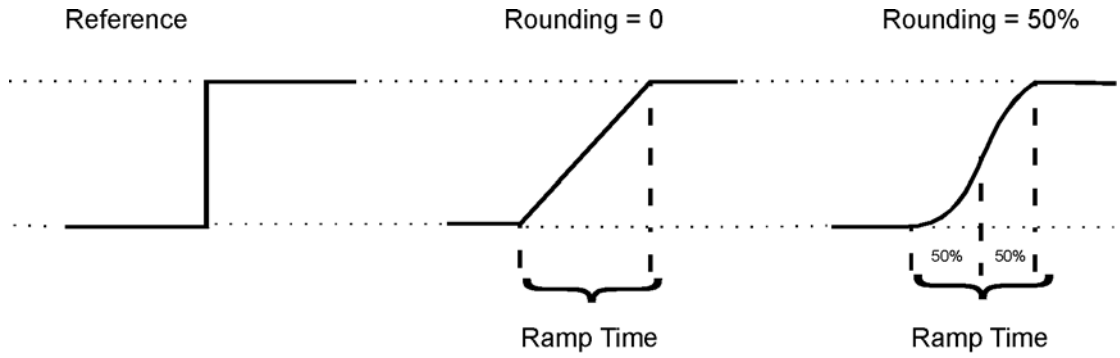
Specifies the amount of reference smoothing (rounding) for the outer control loop. It is set as a percentage of the **[OCL Ramp Time]**. Rounding is performed at the beginning and end of an OCL reference change.

Display/Drive Units:	%
Parameter Range:	0 to 50%
Default Setting:	0%
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0%
Factory Default:	0%
Maximum Value	50%

If **[OCL Ref Rounding]** is set to 0%, the OCL performs a linear ramp function. If set to 50%, the entire ramp time is smoothed: 50% at the beginning of the reference change and 50% at the end.

If **[OCL Ref Ramp Time]** is 0.0 (ramp block bypassed), this parameter has no affect on the OCL reference signal.

Refer to the **[OCL Ramp Time]** block diagram for additional information.



[OCL Ref Source] — P.301

Selects the reference for the outer control loop.

If Register is selected, the reference is obtained from the **[OCL Reference]**.

The I/O Expansion Kit must be installed to use Analog In 3 (terminals 50 and 51 on the I/O expansion board), Analog In 4 (terminals 52 and 53), or Frequency In (terminal 39, 40, and 41).

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Register 1 = Anlg In 3 2 = Anlg In 4 3 = Frequency In 4 = Adapter 1 5 = Adapter 2 6 = Adapter 3 7 = Adapter 4 8 = Adapter 5 9 = Adapter 6
Parameter Type:	Configurable
Group:	Process PI
Minimum Value:	0
Factory Default:	0
Maximum Value	9

Process PI

[OCL Trim Range] — P.302

The trim range for the outer control loop. This specifies the amount of control the outer control loop output signal has on the speed/voltage loop reference. It is set as a percentage of **[Max Process Speed]**. Refer to the **[OCL Lead Freq]** block diagram for additional information.

Display/Drive Units:	%
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0.0%
Factory Default:	0.0%
Maximum Value	100.0%

[OCL Enable] — P.303

Parameter that controls enabling or disabling the OCL when [**OCL Enable Src**] is set to "Register".

Display/Drive Units:	Numeric/Text
Parameter Range:	0 = Enable 1 = Disable
Default Setting:	Disable
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0
Factory Default:	**1**
Maximum Value	1

[OCL Fdbk Reg] — P.304

Allows Outer Control Loop Feedback value to be entered (via Datalink also) when OCL Fdbk Source (P. 290) is set to "Register". This parameter's value is not saved through a power cycle., it is reset to zero at powerup.

Display/Drive Units:	Cnts
Parameter Range:	+/– 4095
Default Setting:	0
Parameter Type:	Tunable
Group:	Process PI
Minimum Value:	0
Factory Default:	**–4096**
Maximum Value	+4095

Parameters (Alphabetical)

This table provides an alphabetized list of 1397 parameters with the associated page number reference for full parameter descriptions.

Name	No.	See Page:	Name	No.	See Page:
Accel Time	037	5–22	AutoTune Type	052	5–27
AC Line Period	192	5–69	AutoTune Stablty	114	5–44
AC Line Voltage	193	5–70	CPU Loading	198	5–71
Alarm Reset	197	5–71	Current Compound	101	5–38
Anlg In 3 Gain	132	5–48	Current Compound TP	173	5–64
Anlg In 3 Type	133	5–48	Curr Loop Error	007	5–15
Anlg In 3 Zero	134	5–49	Cur Loop Fdbk	006	5–15
Anlg In 4 Gain	135	5–49	Cur Loop K Fdbk	061	5–29
Anlg In 4 Zero	136	5–49	Cur Lp Lead Freq	062	5–29
Anlg In 1	001	5–14	Cur Loop Kp	063	5–29
Anlg In 2	002	5–14	Cur Loop RateLim	064	5–30
Anlg In 3	003	5–14	Cur Loop Ref	008	5–16
Anlg In 4	004	5–15	CT Turns Ratio	036	5–22
Anlg In 1 Gain	127	5–47	Data In A1	226	5–78
Anlg In 1 Type	128	5–47	Data In A2	227	5–78
Anlg In 1 Zero	129	5–47	Data In B1	228	5–78
Anlg In 2 Gain	130	5–47	Data In B2	229	5–78
Anlg In 2 Zero	131	5–48	Data In C1	230	5–79
Autotune Bridge	112	5–43	Data In C2	231	5–79
Anlg Out 1 Gain	144	5–51	Data In D1	232	5–79
Anlg Out 1 Src	145	5–52	Data In D2	233	5–79
Anlg Out 1 Zero	146	5–53	Data Out A1	234	5–80
Anlg Out 2 Gain	147	5–53	Data Out A2	235	5–80
Anlg Out 2 Src	148	5–54	Data Out B1	236	5–80
Anlg Out 2 Zero	149	5–55	Data Out B2	237	5–80
Anlg Out 3 Gain	150	5–55	Data Out C1	238	5–81
Anlg Out 3 Src	151	5–56	Data Out C2	239	5–81
Anlg Out 3 Type	152	5–57	Data Out D1	240	5–81
Anlg Out 4 Gain	153	5–57	Data Out D2	241	5–81
Anlg Out 4 Src	154	5–58	Decel Time	038	5–23
Anlg Tach Gain	057	5–28	Direction Mask	202	5–72
Anlg Tach Zero	058	5–28	Direction Owner	216	5–75
Anlg Tach V/1000	047	5–26	Dig Out 1 Src	155	5–59
Armature Bridge	171	5–63	Dig Out 1 Type	156	5–59
Armature Delta	172	5–64	Dig Out 2 Src	157	5–60
Arm Volt	005	5–15	Dig Out 2 Type	158	5–60
Arm Voltage Gain	059	5–28	Draw Percent Out	009	5–16
Arm Voltage Zero	060	5–29	Drive Status	191	5–69
AutoTune Fld Rng	113	5–44	E–Fld Volts Adj	272	5–87

Name	No.	See Page:	Name	No.	See Page:
Encoder Fdbk	189	5–68	J18 Arm Fdbk Res	183	5–67
Encoder Kit	187	5–68	J20 Fld Loss Det	184	5–67
Encoder PPR	048	5–26	J21 Field Supply	185	5–67
Encoder Quad	049	5–27	Drive Status	191	5–69
Expansion I/O	178	5–65	AC Line Period	192	5–69
Exp I/O Dig In	195	5–70	Last Stop Cause	166	5–62
Fault Reset	196	5–70	Local Mask	208	5–74
Fault Reset Mask	205	5–73	Local Owner	221	5–77
Flt Reset Owner	219	5–77	Logic Mask	207	5–74
Feedback Type	039	5–23	Logic Status	190	5–69
Field Delta	174	5–64	Monitor 1 Delay	103	5–39
Field Feedback	010	5–16	Monitor 1 Level	105	5–40
Field Ref TP	176	5–65	Motor Field Amps	044	5–25
Fld Auto Weak	275	5–88	Monitor 1 Source	104	5–40
Fld Econ Active	175	5–64	Monitor 2 Delay	106	5–41
Field Regulator	177	5–65	Monitor 2 Level	108	5–42
Fld Delta Hi Lim	276	5–88	Maximum Current	040	5–23
Fld Econ Delay	273	5–87	Max Motor Speed	041	5–23
Fld Econ Ref	274	5–87	Max Process Spd	042	5–24
Fld Lp Lead Freq	278	5–89	Min Process Speed	043	5–24
Fld Loop K–Fdbk	281	5–90	Min Speed Bypass	099	5–38
Fld Loop Kp	279	5–89	Monitor 1 Output	013	5–17
Fld Loss Level	277	5–89	Monitor 2 Output	014	5–17
Field Reference	280	5–90	Motor Field Amps	044	5–25
Fld Weak Ld Freq	282	5–90	MOP Accel Time	084	5–34
Fld Weaken Kp	283	5–90	MOP Decel Time	085	5–34
Fld Weaken Level	284	5–90	MOP Mask	206	5–73
Frequency In	011	5–16	MOP Output	015	5–17
Frequency In Scale	137	5–49	MOP Reset Enable	086	5–34
Freq In Zero	138	5–50	MOP Owner	220	5–77
Freq Out Src	160	5–61	Motor Arm Amps	045	5–25
Freq Out Scale	159	5–60	Motor Arm Volts	046	5–26
Freq Out Zero	161	5–62	Neg Current Lim	068	5–30
IR Compensation	066	5–30	Neg Cur Lim Src	070	5–31
Inertia Comp Src	102	5–39	Normal Inertia	109	5–42
Inertia Comp Reg	122	5–46	Nominal AC Freq	050	5–27
IR Comp TP	179	5–65	Nominal AC Volt	051	5–27
Jog Acc/Dec Time	092	5–36	NOT Ready Cause	199	5–71
Jog Mask	203	5–72	OCL Enable TP	016	5–18
Jog Owner	217	5–76	OCL Enable Src	121	5–46
Jog Ramp Output	012	5–17	OCL Feedback	017	5–18
Jog Reference	093	5–36	OCL Fdbk Reg	304	5–96
Jog Off Dly Time	094	5–37	OCL Fdbk Source	290	5–91
J11 Tach V Scale	180	5–66	OCL Kp	294	5–92
J14 Tach V Range	181	5–66	OCL LeadLag Ratio	292	5–92
J15 Reg Type	182	5–66	OCL LeadLag Type	293	5–92

Name	No.	See Page:	Name	No.	See Page:
OCL LeadLag Freq	291	5–91	Reference Owner	218	5–76
OCL Output	018	5–18	Regulator SW Ver	188	5–68
OCL Lead Freq	295	5–93	Reverse Disable	110	5–42
OCL Neg Limit	297	5–93	Run Mask	201	5–72
OCL Pos Limit	296	5–93	Run Owner	215	5–75
OCL Enable	303	5–96	S–Curve Rounding	111	5–43
OCL Ramp Output	019	5–18	Scanport Errors	200	5–71
OCL Ramp Time	298	5–94	Spd Loop Error	021	5–19
OCL Reference TP	020	5–18	Spd Lp Lag Type	076	5–33
OCL Reference	299	5–94	Spd LeadLag Type	074	5–33
OCL Ref Rounding	300	5–95	Spd Lp Lag Freq	075	5–33
OCL Ref Source	301	5–95	Spd Loop Fdbk	022	5–19
OCL Trim Range	302	5–96	Spd Loop Lag Out	023	5–19
Open SCR Sens	275	5–88	Spd Loop Kp	078	5–33
Open SCR Trip Pt	128	5–47	Spd Loop Output	024	5–19
Phase Tst Bridge	276	5–88	Spd Loop Ref	025	5–20
Pos Current Lim	067	5–30	Spd Lp Lead Freq	077	5–33
Pos Curr Lim Src	069	5–31	Spd Ramp In TP	027	5–20
Power Unit Type	186	5–67	Spd Ramp Output	028	5–20
Preset Speed 1,2 and 3	87,88 and 89	5–35	Spd Src Out	026	5–20
PLL Max Error	071	5–32	Speed Pot	029	5–21
Process 1 Par	247	5–82	Stop Owner	214	5–75
Process 1 Scale	248	5–82	Stop Mode Type	115	5–44
Process 1 Text 1	249	5–82	Stop Speed Level	116	5–44
Process 1 Text 2	250	5–82	Tach Loss Angle	079	5–33
Process 1 Text 3	251	5–83	Torque Reference	031	5–21
Process 1 Text 4	252	5–83	Trim Mode Type	117	5–45
Process 1 Text 5	253	5–83	Trim Range	118	5–45
Process 1 Text 6	254	5–83	Trim Reference	120	5–46
Process 1 Text 7	255	5–84	Trim Ref Source	119	5–45
Process 1 Text 8	256	5–84	Trim Output	030	5–21
Process 2 Par	257	5–84			
Process 2 Scale	258	5–84			
Process 2 Text 1	259	5–85			
Process 2 Text 2	260	5–85			
Process 2 Text 3	261	5–85			
Process 2 Text 4	262	5–85			
Process 2 Text 5	263	5–86			
Process 2 Text 6	264	5–86			
Process 2 Text 7	265	5–86			
Process 2 Text 8	266	5–86			
Ref Ramp Bypass	100	5–38			
Reference Mask	204	5–73			
Ref 1 Source	090	5–35			
Ref 2 Source	091	5–36			

Hidden Parameters

The parameters shown in the following table are **unused** and are hidden in 1397 Drives with V 1.XX or greater firmware. These parameters are for future expansion of functions in the Drive and have no effect on Drive operation. These parameters are neither visible nor accessible through the HIM. When using DriveTools or DeviceNet manager, however, all parameters can be seen (even ones marked as hidden). While visible, they **are not** functional.

Hidden Parameter Name	No.	Hidden Parameter Name	No.
Metering 1	032	OUT CFG 4	165
Metering 2	033	MASKS 1	209
Metering 3	034	MASKS 2	210
Metering 4	035	MASKS 3	211
Setup 2	053	MASKS 4	212
Setup 3	054	MASKS 5	213
Setup 4	055	OWNERS 2	222
Setup 5	056	OWNERS 3	223
Metering 5	065	OWNERS 4	224
ADV SETUP 2	080	ADAPT IO 1	242
ADV SETUP 3	081	ADAPT IO 2	243
ADV SETUP 4	082	ADAPT IO 3	244
ADV SETUP 5	083	ADAPT IO 4	245
REF SETUP 2	095	ADAPT IO 5	246
REF SETUP 3	096	PROC DISP 1	267
REF SETUP 4	097	PROC DISP 2	268
REF SETUP 5	098	PROC DISP 3	269
FEATR SEL 1	122	PROC DISP 4	270
FEATR SEL 2	123	PROC DISP 5	271
FEATR SEL 3	124	FIELD 1	285
FEATR SEL 4	125	FIELD 2	286
FEATR SEL 5	126	FIELD 3	287
IN CFG 1	082	FIELD 4	288
IN CFG 2	083	FIELD 5	289
IN CFG 3	095	PROC PI 2	305
IN CFG 4	096	PROC PI 3	306
IN CFG 5	097	PROC PI 4	307
OUT CFG 1	098	PROC PI 5	308
OUT CFG 3	123		

Troubleshooting

Introduction

Chapter 6 provides a guide to help you troubleshoot the 1397 Drive. Included is a listing and description of the various Drive faults and alarms with possible solutions, when applicable.

ATTENTION: Only qualified personnel familiar with the 1397 Drive and associated machinery should perform troubleshooting or maintenance functions on the Drive. Failure to comply may result in personal injury and/or equipment damage.

During Startup you should have recorded board jumper settings for each board, software version numbers, and the Drive and motor nameplate data in Tables 4.A, 4.E and 4.G. If they were not, record them at this time before beginning any troubleshooting procedures.

Required Equipment

For initial troubleshooting, a HIM programming device is required to read fault codes. In addition to a programming device, the following equipment is recommended before initiating any troubleshooting procedures:

- ❑ Digital Multimeter (DMM) capable of 1000V DC/750VAC, with one megohm minimum input impedance.
- ❑ Clamp on Ammeter (AC/DC) with current ratings to 2X rated current output of 1397 DC Drive.
- ❑ Dual trace oscilliscope with differential capability, digital storage, two X10 and one X100 calibrated probes (optional but recommended).

ATTENTION: Potentially fatal voltages may result from improper useage of an oscilliscope and other test equipment. The oscilliscope chassis may be at potentially fatal voltage if not properly grounded. Allen-Bradley does not recommend use of an oscilliscope to directly measure high voltages. Use an isolated measuring device with a high voltage probe. Contact Allen-Bradley for recommendations.

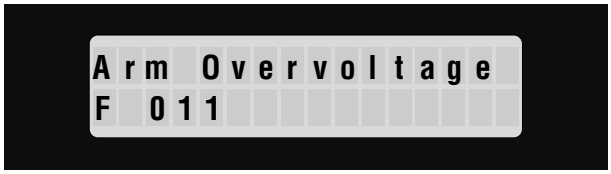
- ❑ Hand tachometer used to monitor motor velocities.
- ❑ HIM Programming Device Instruction Manual and reference manuals for any option used with the 1397 Drive.

ATTENTION: The **[CT Turns Ratio]** (Param 36) is used in the calculation of the burden resistor value. Do not adjust/change the value of this parameter from its factory set value unless you are replacing the regulator board. Failure to observe this precaution could result in damage to, or destruction of, the equipment. Refer to Chapter 5 if the CT Turns Ratio value needs to be changed from the factory supplied value.

HIM Fault Display

The HIM LCD display is used to indicate a fault by displaying a fault code and fault number (See Figure 6.1).

Figure 6.1
Typical Fault Description Display



Clearing a Fault

When a fault occurs in the 1397, the cause must be corrected before the fault can be cleared. After corrective action has been taken, simply cycling Drive power will clear a fault.

NOTE: The HIM and other SCANport peripherals can clear faults as well as the Fault Queue. If a stop push button is used, terminal 10 can also clear a fault.

Clearing an Alarm

When an alarm occurs in the 1397, the cause must be corrected before the alarm can be cleared. After corrective action has been taken, perform the following steps to clear the alarm:

1. In the Control Status menu cycle to the Alarm Queue using the increment and decrement key.
2. Press Enter.
3. Press the Increment (or Decrement) key until “Clear Queue” is displayed.

The alarm queue is now cleared.

Table 6.A
1397 Fault Descriptions

Fault No.	Fault Name	Description	Action
001	**"IET Overcurrent"**	Armature current instantaneously exceeded 180% of [Maximum Current] (P.040) Possibly due to: • Incorrect armature current feedback scaling • One or more thyristors not operating • Improper Current Minor Loop tuning • Motor Armature winding damaged	Check the motor and all thyristors. Ensure that armature current feedback scaling is correct. Replace the motor if necessary.
002	**"Tachometer Loss"**	Tachometer feedback signal missing possibly due to: • Tach coupling broken or loose • Disconnected, loose or damaged tach wires • Pulse Tach supply voltage low • Incorrect Analog Tach scaling • Incorrect Pulse Tach configuration • Motor armature winding not connected or open circuit • Blown DC fuse • Tach malfunction	Check the tach coupling, tach scaling, tach configuration, fuses and motor armature windings. Relplace the tach and/or motor if necessary.
003	**"Overspeed Fault"**	Motor Speed exceeded 110% of [Max Motor Speed] (P.041) possibly due to: • Incorrect tach scaling • Blown field supply fuses • Improper speed loop tuning • Pulse Tach Quadrature set to ON for a non–regenerative drive. • Incorrect pulse tach wiring	Check pulse tach wiring, tach scaling, fuses and speed loop tuning. Replace tach if necessary.
004	**"Fld Current Loss"**	The field loss detection circuit has not sensed any field current flowing in the motor shunt field possibly due to: • Motor field winding not connected or an open circuit • Blown field supply fuse(s) • Blown AC line fuse(s) • Field supply failure • Wiring harness damaged, loose or disconnected	Check fuses, field supply, wiring and motor windings. Replace motor if necessary.
005	**"Sustained Overld"**	Inverse time overload circuit trip possibly caused by: • Incorrect armature current feedback scaling • Blown A C line fuses • Mechanical binding preventing the motor shaft from rotating freely	Check process equipment and motor for binding. Check for blown fuses. Check armature current feedback scaling. Replace motor if necessary.
006	**"Blower Starter"**	Blower motor starter is open. If a blower motor starter kit is not installed, connector P8 must be fitted with the proper substitute connector to inhibit this fault. Other possible causes: • Blown motor starter fuse(s) • Disconnected, loosely connected or damaged blower motor starter wiring • Blower motor overload	Check motor starter fuses and wiring. Replace blower motor starter and/or blower motor if necessary.
007	**"Open Armature"**	The motor armature circuit is open possibly due to: • Motor armature winding not connected or an open circuit • Blown inverting fault (DC) fuse • Inverting fault breaker tripped	Check breakers and fuses. Check motor armature windings. Replace motor if necessary.

Fault No.	Fault Name	Description	Action
008	**"Motor Over Temp"**	The motor thermostat is indicating a high temperature, or if no motor thermostat is installed, the customer terminal board pins 13 and 14 have not been jumpered correctly to inhibit this fault: Other possible causes Include: • Damaged thermostat or disconnected wiring • Inadequate ventilation • Blower Motor Malfunction • Incorrect blower rotation • Blocked ventilation slots • Clogged filters • Excessive armature current • One or more thyristors inoperable	Check filters, blowers and thermostat, repairing or replacing as necessary. Replace thyristors if necessary. Check motor ventilation and provide additional air movement or cooling if necessary.
009	**"Cntlr Over Temp"**	The Controller thermostat is indicating an overtemperature condition possibly due to: • Inadequate heat sink ventilation • Inadequate cabinet ventilation • Heat sink fan malfunction • Damaged, disconnected or improperly connected thermostat wiring	Check the fan and thermostat repairing or replacing as necessary. Check cabinet & heat sink ventilation and provide additional air movement or cooling as required.
010	**"AC Line Sync Flt"**	Three–phase AC line synchronization circuit malfunction possibly due to: • Blown AC line fuses (s) • AC line frequency outside the required range of 48–62Hz • Excessive AC line noise or distortion • Unstable AC line frequency • Disconnected, improperly connected or damaged J6 ribbon cable	Check all cables and connections. Replace blown line fuses if necessary. Line filters or a transformer may be necessary to cure line frequency or noise problems.
011	**"Arm Over Voltage"**	Armature voltage exceeded 130% of Motor Arm Volts (Par 046) due to: • Motor Arm Volts not set properly • Improper voltage loop tuning • [E–Fld Volts Adj] (Par 272) set too high (Enhanced Field Supply only).	Reset Parameters 44 and 272 if necessary. Rerun Voltage Loop Tuning if required.
012	**"CAN Comm Lost"**	Drive to Drive or Drive to Control communication lost.	Check attached communication peripherals for proper operation. Replace if necessary.
015	**"SCR #1 Open Flt"**	Indicates SCR number 1 is non–operational	Check SCR wiring and connections and replace SCR if necessary
016	**"SCR #2 Open Flt"**	Indicates SCR number 2 is non–operational	Check SCR wiring and connections and replace SCR if necessary
017	**"SCR #3 Open Flt"**	Indicates SCR number 3 is non–operational	Check SCR wiring and connections and replace SCR if necessary
018	**"SCR #4 Open Flt"**	Indicates SCR number 4 is non–operational	Check SCR wiring and connections and replace SCR if necessary
019	**"SCR #5 Open Flt"**	Indicates SCR number 5 is non–operational	Check SCR wiring and connections and replace SCR if necessary
020	**"SCR #6 Open Flt"**	Indicates SCR number 6 is non–operational	Check SCR wiring and connections and replace SCR if necessary
021	**"SCR #11 Open Flt"**	Indicates SCR number 11 is non–operational	Check SCR wiring and connections and replace SCR if necessary
022	**"SCR #12 Open Flt"**	Indicates SCR number 12 is non–operational	Check SCR wiring and connections and replace SCR if necessary

NOTE: Incorrect setting of **[CT TURNS RATIO]** (P. 036) can also cause faults 015 thru 027. Set the correct value in Parameter 36 and repeat the jumper setting and autotune process.

Fault No.	Fault Name	Description	Action
023	**"SCR #13 Open Flt"**	Indicates SCR number 13 is non–operational	Check SCR wiring and connections and replace SCR if necessary
024	**"SCR #14 Open Flt"**	Indicates SCR number 14 is non–operational	Check SCR wiring and connections and replace SCR if necessary
025	**"SCR #15 Open Flt"**	Indicates SCR number 15 is non–operational	Check SCR wiring and connections and replace SCR if necessary
026	**"SCR #16 Open Flt"**	Indicates SCR number 15 is non–operational	Check SCR wiring and connections and replace SCR if necessary
027	**"Multi SCR's Open"**	One or more thyristor (SCR) is not carrying an equal load possibly due to: • Disconnected, loosely connected or damaged thyristor gating circuit. • Blown AC line fuse(s) • Improper Speed/Voltage Loop tuning • Malfunctioning thyristor (SCR)	Check SCRs, SCR wiring and AC Line fuses. Repair or replace as necessary. Run Speed/Voltage Loop tuning if necessary.
030–044	**"SCR Shorted Flt"**	One or more SCRs have shorted out possibly due to: • Improper Heat Sink preparation • Improper Torqueing of SCR	Replace shorted SCRs using the correct heat sink compound and torqueing techniques.
045	**"SelfTune Abort"**	Auto Tune aborted by external input Possible causes include: • Operator stop initiated • Drive interlock(s) open • Drive fault became active	Check for drive faults, open interlocks or programmed stop routines. Cycle power to reset drive and attempt to run Auto Tune again.
046	**"ST Spd Fdbk Flt"**	A non-zero speed feedback value exists at self tune start possibly due to: • Incorrect speed feedback scaling or offset • Overhauling load causing motor shaft rotation	Check process equipment to determine if overhauling load exists. If not, reset feedback scaling and offset.
047	**"ST Inductance"**	Calculated armature inductance is out of range possibly due to: • Motor armature winding not connected or an open circuit exists. • Blown inverting fault (DC) fuse • Inverting fault breaker tripped • Armature inductance too high, tune current loop manually	Check for blown fuses and open circuit breakers, replace, reset and tune as necessary. Check motor armature inductance and windings. Repair or replace as necessary.
048	**"ST Max Current"**	A maximum current condition with minimum rotation exists possibly due to: • Inability of the motor to rotate freely due to mechanical friction. • Motor load is too high • Motor field is not at normal operating temperature	Check the process equipment for possible overloads caused by bad bearings, slipping belts, outside interference etc. Uncouple motor from load and check that it rotates freely when unloaded.
049	**"ST Inertia Fault"**	Attached inertia is out of range possibly due to: • Maximum Auto Tune speed reached • Overhauling load present • High mechanical friction present • The Speed Loop cannot be auto tuned. Tune Speed Loop manually.	Check the process equipment for a possible overhauling load condition. Check process equipment for overload or mechanical binding condition.
050	**"ST Stability Flt"**	Speed instability exists possibly due to: • Current Loop not properly tuned prior to the Speed Loop • Tachometer feedback connected incorrectly	Check tachometer leads for damage, incorrect connection or improper conduit routing of leads.
051	**"ST Stab<50 Fault"**	Auto Tune Stablty is too low, due to: • Specified stability is less than that calculated by current loop tuning.	Use 50 or greater.
052	**"ST Stab<75 Fault"**	Auto Tune Stabilty is too low, possibly due to: • Specified stability is less than that calculated by current loop tuning.	Use 75 or greater.
074–084	**"ST Fatal Fault"**	An autotuning fault occurred, with self tuning unable to complete its routine.	Attempt to rerun autotune routine, or tune manually to bypass the problem.

Fault No.	Fault Name	Description	Action
085	**"Main Contactor"**	The main (FN) contactor did not open following a run or jog. Possible causes include: • Disconnected, loosely connected, or damaged FN, FN AUX, Dynamic Braking or Auxiliary Dynamic Braking wiring. • FN, FN AUX, DB or DB AUX contactor malfunction • Disconnected, loosely connected, or damaged main contactor or dynamic braking control wiring (MCR or DBCR)	Check all wiring and connections to the dynamic brake and dynamic brake contacts. Repair or replace as necessary.
086	**"Power Failure"**	The power supply input voltage momentarily went below tolerance. Possible causes include: • AC line voltage dip (20% tolerance) • Disconnected, loosely connected, or damaged J7 ribbon cable or power supply input wiring	Check J7 ribbon cable and power supply input wiring, repair or replace as necessary. If AC line voltage dips are occuring regularly, an isolation transformer or line reactor may be required.
087	**"NVM Checksum Flt"**	• EEPROM Checksum invalid	• Restore factory defaults • Save to EEPROM • Clear fault queue. Reset all parameters to correct values
088	**"Fault Log Error"**	The fault log information stored in retentive memory was determined to be invalid, the fault log has been cleared. Possible causes include: • Power loss occurred during a prior fault log save • Regulator Board malfunction	Check regulator board and replace if necessary.
089	**"Invalid Field"**	The installed field supply is not supported by the regulator possibly due to: • Disconnected, loosely connected or damaged field supply wires. • Regulated field supply malfunction • Regulator board malfunction	Check the field supply wiring, the regulated field suppy and the regulator board. Repair or replace as necessary.
090	**"Fld Fdbk Offset"**	Regulated field supply feedback offset is too high, possibly due to: • Disconnected, loosely connected or damaged field supply wires • Regulated field supply malfunction • Regulator board malfunction	Check the field supply wiring, the regulated field suppy and the regulator board. Repair or replace as necessary.
091	**"uP HW/SW Fault"**	• Regulator microprocessor malfunction • Electrical noise due to improper wiring practices or unsuppressed brake coils, relays, or contactors. • Disconnected, loosely connected or damaged Microbus ribbon cable. • Malfunctioning regulator board	Check regulator board and replace if necessary.
100–599	**"Microbus Fault"**	An error occurred on the Microbus possibly due to: • Electrical noise due to improper wiring practices or unsuppressed brake coils, relays, or contactors. • Disconnected, loosely connected or damaged Microbus ribbon cable. • Malfunctioning regulator board • Malfunctioning microbus peripheral • Microbus peripheral found that is not supported by the regulator firmware.	Check the microbus ribbon cable and replace if necessary. Check the regulator board and replace if necessary. Check for noise sources and correct if possible. Make certain all leads and wiring are separated correctly and run in proper conduit with correct shield terminations.
600–699	**"Memory Fault"**	• Regulator board memory malfunction	Check regulator board and replace if necessary.
700–749	**"uP Hardware Flt"**	• Regulator board hardware malfunction	Check regulator board and replace if necessary.
750–799	**"uP Exception Flt"**	• Unexpected regulator board interrupt. • Possibly due to electrical noise from improper wiring practices or unsuppressed brake coils, relays or contactors.	Check regulator board and replace if necessary.

Alarms

Table 6.B presents a listing and description of the Drive alarms. CTB = Control Terminal Block in the following table.

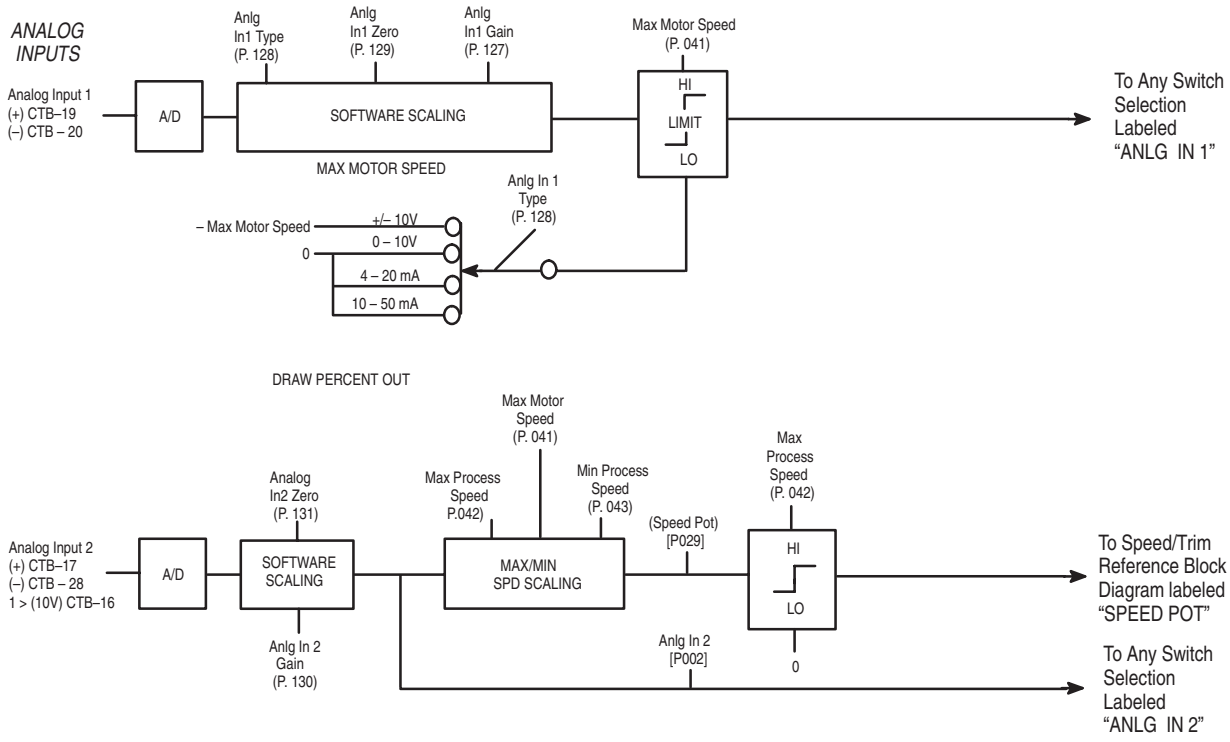
Table 6.B
Alarm Conditions

Alarm No.	Alarm Name	Description
001	**"Brush Wear Low"**	The Motor brush wear detector indicates the brushes are worn, or that the customer terminal block pins CTB–12 & CTB–14 have not been jumpered in cases where a brush wear detector is not supplied Other possible causes include: • Disconnected, loosely connected or damaged motor brush wear indicator wiring • Brush wear indicator has malfunctioned.
002	**"AC Line Volt Low"**	The AC line voltage has fallen below 90% of the figure established in Nominal AC Line Voltage. Possible causes include: • Low AC line voltage • An incorrect value has been entered for Nominal AC Volts (P. 051) • Blown AC line fuse(s)
003	**"AC Line Vlt High"**	The AC line voltage rose 115% above the figure established in Nominal AC Volts (P.051) Possible causes include: • High AC line voltage • Incorrect value entered for Nominal AC Volts (P. 051)
020	**"Fld Loss Det Dis"**	Field Loss detection has been disabled through a jumper on the regulator board (J20). NOTE: Option used only when no field exists.
030	**"Contcr Not Open"**	The main (FN) contactor did not open following a stop. If a dynamic braking (DB) kit is used, the DB AUX contact is wired in series with the FN AUX contact Possible causes include: • Disconnected, loosely connected or damaged FN, FN AUX, DB or DB AUX wiring. • FN, FN AUX, DB or DB AUX contactor failure. • Disconnected, loosely connected or damaged main contactor or dynamic brake control wiring (MCR or DBCR).
031	**"Contcr Not Closed"**	The main (FN) contactor did not close following a run or jog command. If a dynamic braking (DB) kit is used, the DB AUX contact is wired in series with the FN AUX contact. Possible causes include: • Disconnected, loosely connected or damaged FN, FN AUX, DB or DB AUX wiring. • FN, FN AUX, DB or DB AUX contactor failure. • Disconnected, loosely connected or damaged main contactor or dynamic brake control wiring (MCR or DBCR).
032	**"Sustained Speed"**	Motor speed did not fall below the value set in Stop Speed Level (P. 116) in the required period of time during a stop (automatically set to 2x the Decel Time (P. 038) setting). Possible causes include: • Decel Time not set properly • Stop Speed Level (P.116) not set properly • Incorrect speed/voltage feedback scaling
033	**"Sustained Arm I"**	Armature current was unable to reach discontinuous conduction while stopping the Drive. Possible causes include: • Motor CEMF too high or line voltage too low for proper commutation
034	**"Aux Contact Open"**	M Contactor Auxiliary contact opened unexpectedly – check contactor for proper operation.

Alarm No.	Alarm Name	Description
050	**"CML Fdbk Scaling"**	Armature current feedback could not be scaled properly based on the values entered for Motor Arm Amps (P. 045) and Maximum Current (P.040). Verify that CT Turns Ratio (P.036) has been set to the value shown in the user manual that corresponds to your drive type.
051	**"Low Min Speed"**	The Min Process Spd (P. 043) value is less than 10% of the Max Process Spd (P. 042) value. This alarm will **not** be triggered on power–up. It only occurs when maximum or minimum speed has changed. Verify that these parameter values are correct for your application.
700	**"NV Mem Save Fail"**	An attempt to save information (parameter values, fault log data etc.) to retentive memory failed. The drive may continue to be operated. A possible cause of this error is a Regulator Board Malfunction

Firmware Block Diagrams

Figure A.1
Standard Inputs



1 ➔ J19 must be set to POT (2–3) to use the internal 10V power supply

* = Default Selection

Figure A.2
I/O Expansion Inputs

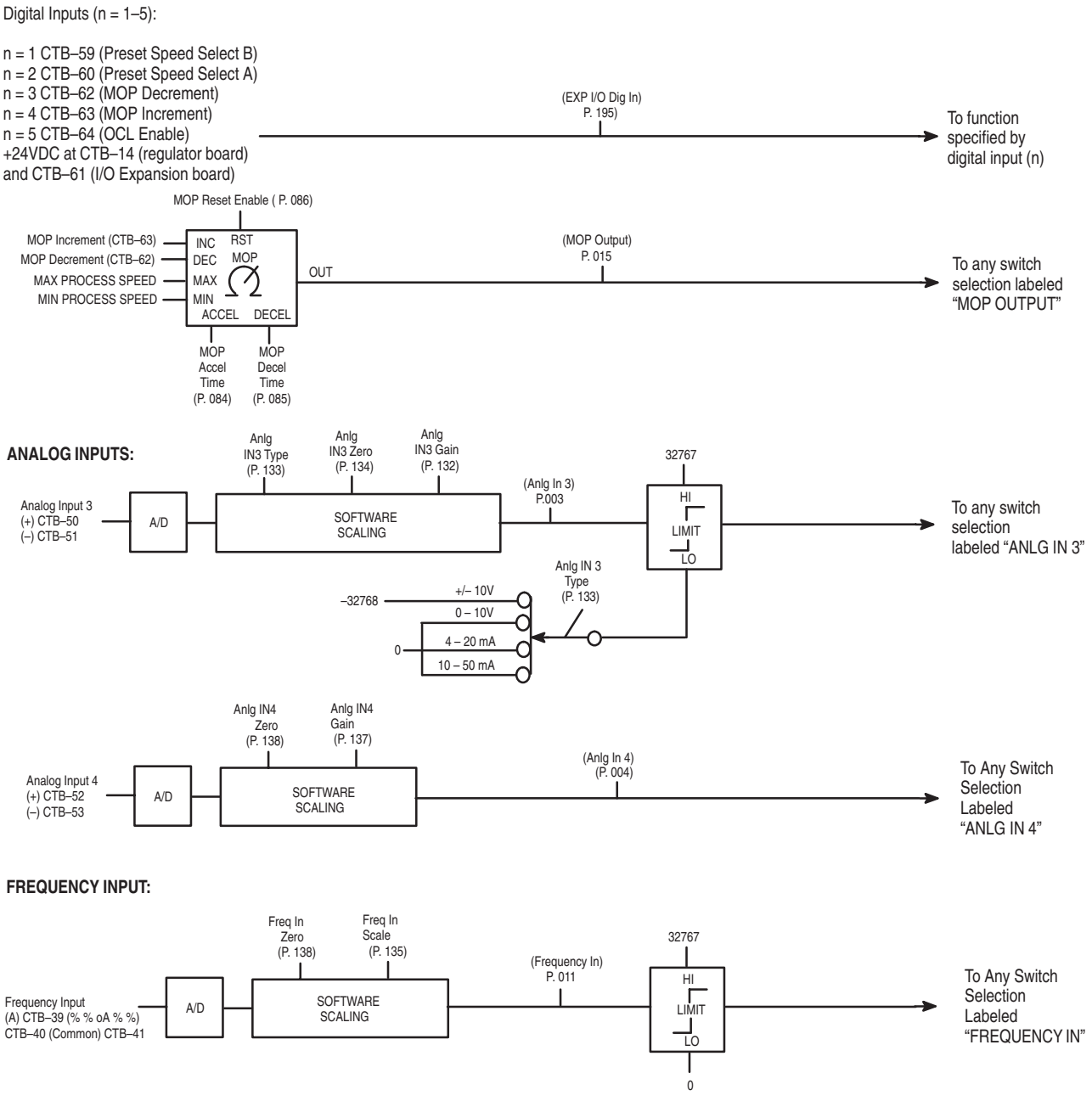


Figure A.3
Speed/Trim Reference Select

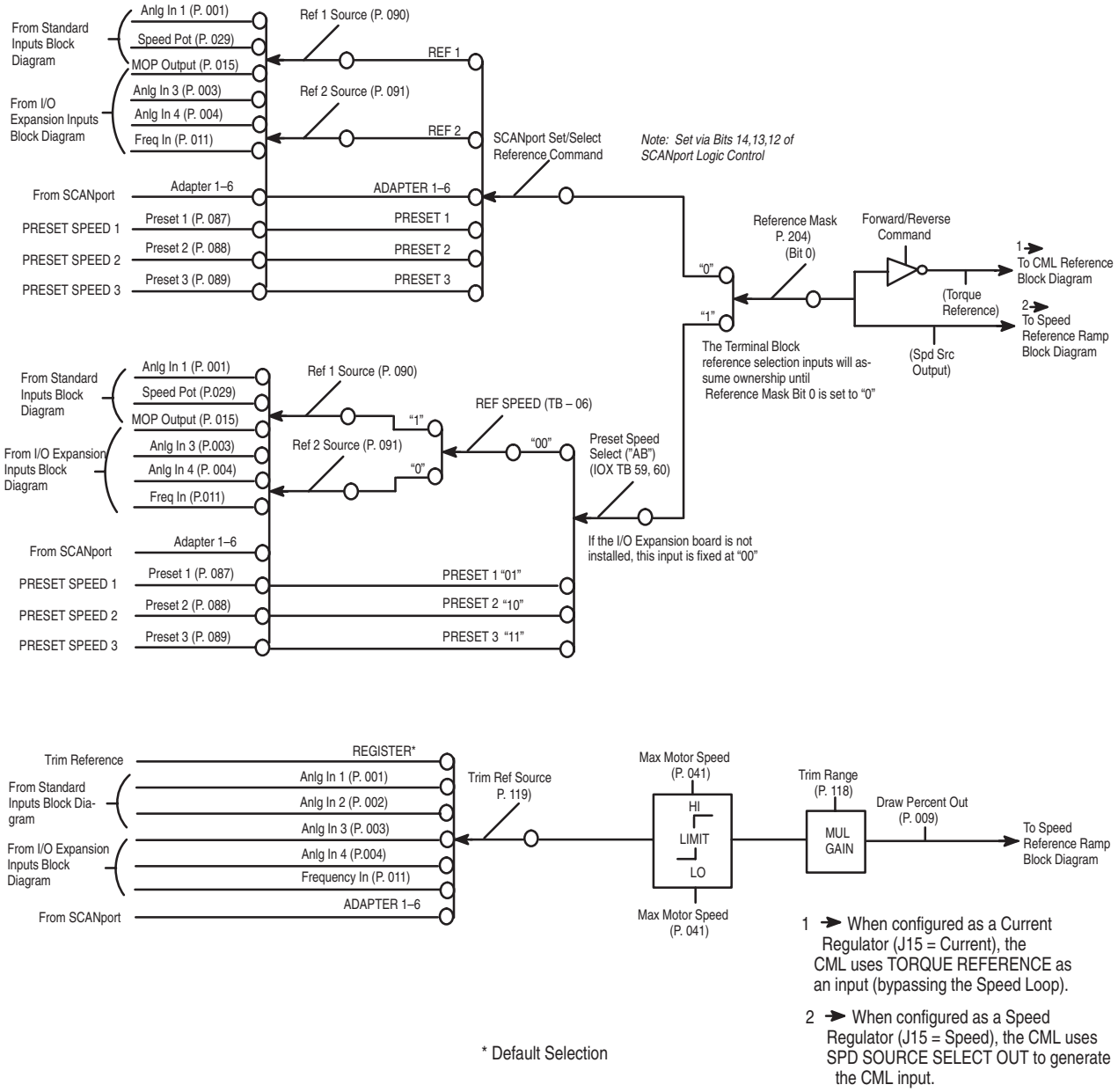
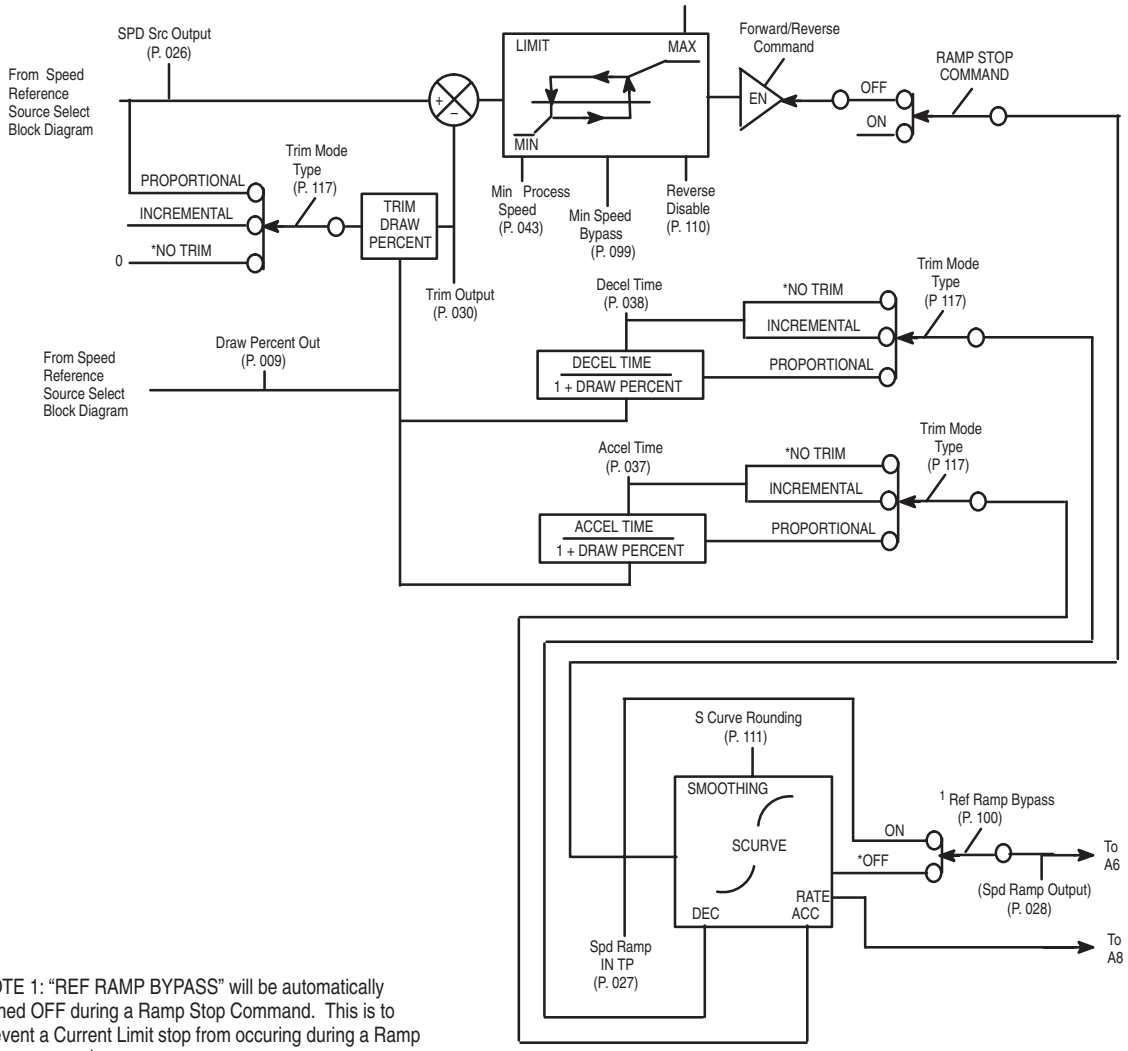
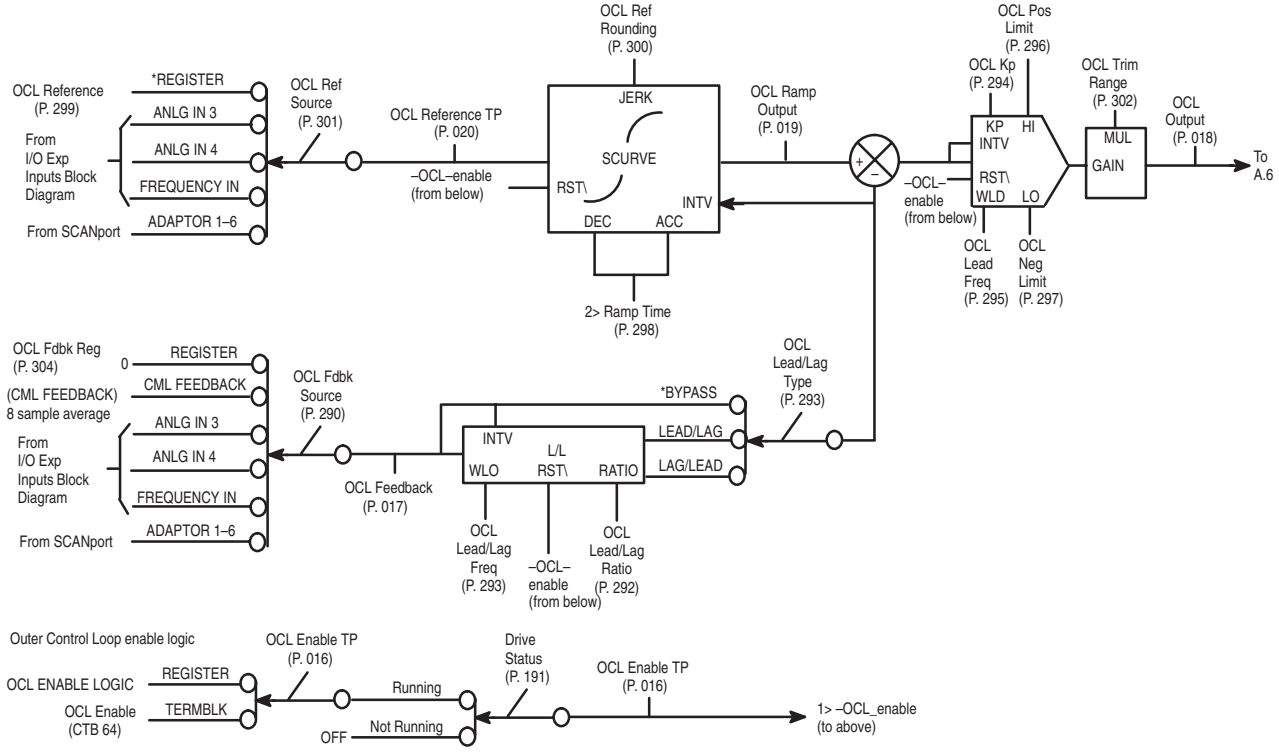

From Standard Inputs Block Diagram
Anlg In 1 (P. 001)
Speed Pot (P. 029)
MOP Output (P. 015)
From I/O Expansion Inputs Block Diagram
Anlg In 3 (P. 003)
Anlg In 4 (P. 004)
Freq In (P. 011)
From SCANport
Adapter 1–6
PRESET SPEED 1
Preset 1 (P. 087)
PRESET SPEED 2
Preset 2 (P. 088)
PRESET SPEED 3
Preset 3 (P. 089)
Ref 1 Source (P. 090)
Ref 2 Source (P. 091)
REF 1
REF 2
ADAPTER 1–6
PRESET 1
PRESET 2
PRESET 3
SCANport Set/Select Reference Command
Note: Set via Bits 14,13,12 of SCANport Logic Control
Reference Mask P. 204) (Bit 0)
Forward/Reverse Command
"0"
"1"
1 To CML Reference Block Diagram
(Torque Reference)
2 To Speed Reference Ramp Block Diagram
(Spd Src Output)
The Terminal Block reference selection inputs will assume ownership until Reference Mask Bit 0 is set to "0"
REF SPEED (TB – 06)
"00"
Preset Speed Select ("AB") (IOX TB 59, 60)
If the I/O Expansion board is not installed, this input is fixed at "00"
PRESET 1 "01"
PRESET 2 "10"
PRESET 3 "11"
Trim Reference
REGISTER*
Anlg In 2 (P. 002)
Frequency In (P. 011)
Trim Ref Source P. 119)
Max Motor Speed (P. 041)
HI
LIMIT
LO
Trim Range (P. 118)
MUL GAIN
Draw Percent Out (P. 009)
To Speed Reference Ramp Block Diagram
1 ➔ When configured as a Current Regulator (J15 = Current), the CML uses TORQUE REFERENCE as an input (bypassing the Speed Loop).
2 ➔ When configured as a Speed Regulator (J15 = Speed), the CML uses SPD SOURCE SELECT OUT to generate the CML input.
* Default Selection

Figure A.4
Speed Reference Ramp



NOTE 1: “REF RAMP BYPASS” will be automatically turned OFF during a Ramp Stop Command. This is to prevent a Current Limit stop from occuring during a Ramp Stop command.

Figure A.5
Outer Control Loop

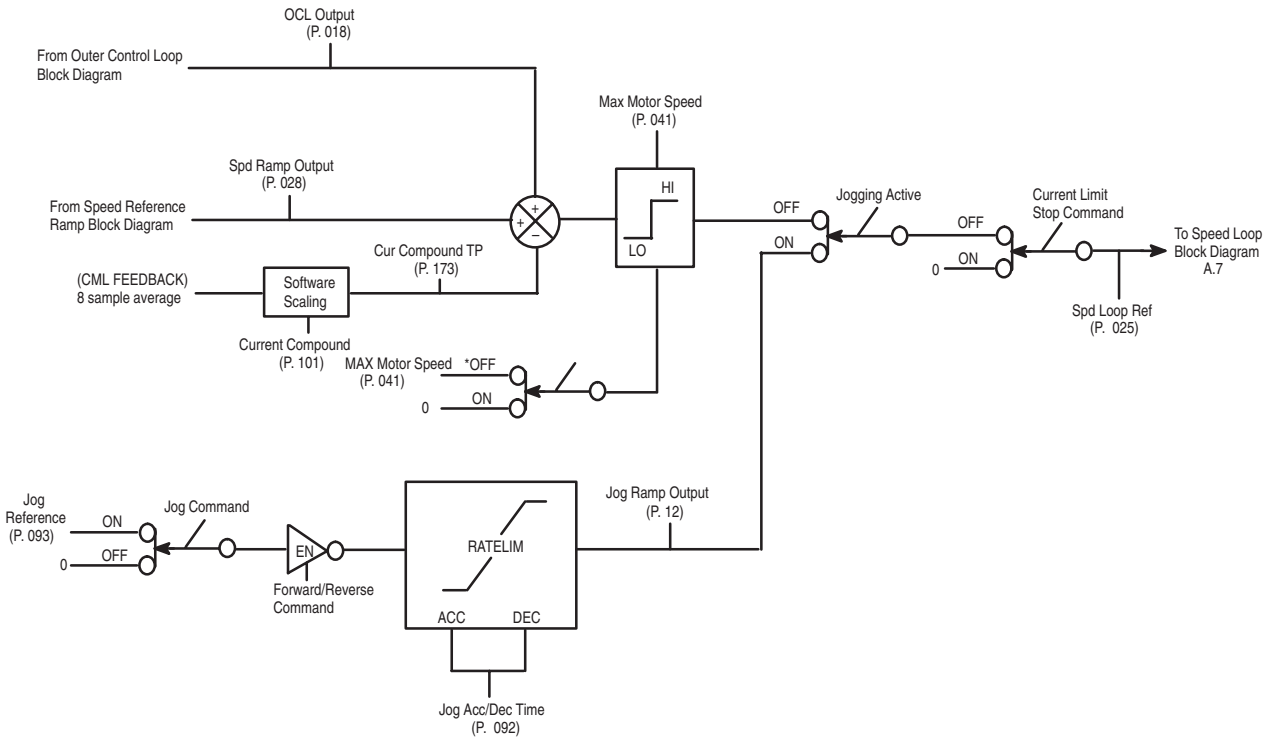


NOTES:
1>The –_oct_– enable signal must be ON in order for the Outer Control Loop to execute. When _ocl_ enable is OFF, the S–curve Lead/Lag and PI blocks are held in reset causing the initial value (INITV) to be copied to each block's output.

2> The OCL reference ramp block can be bypassed by setting OCL RAMP TIME to 0.0.

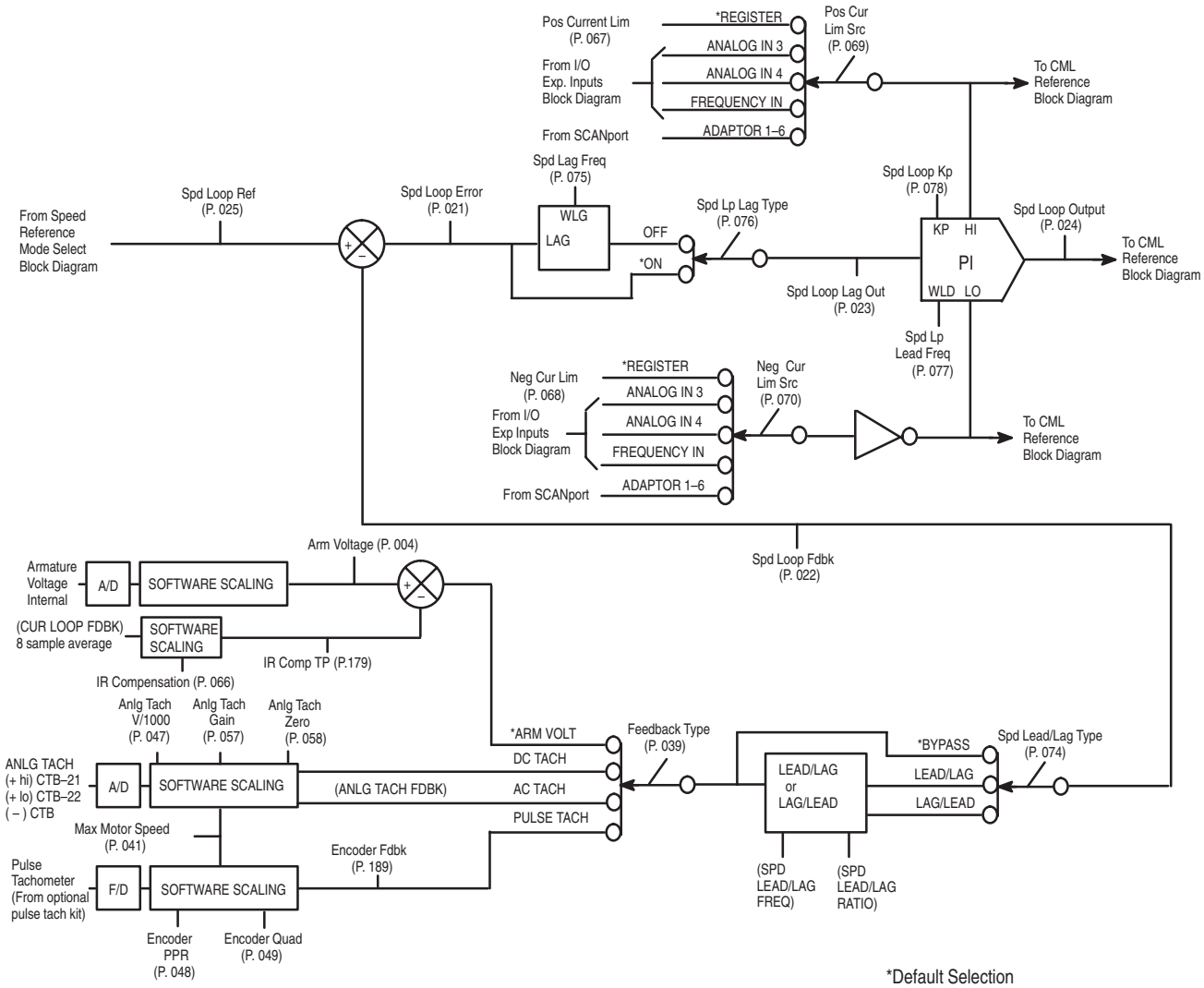
*Indicates default selection

Figure A.6
Speed Reference Mode Select



*Indicates default selection

Figure A.7
Speed Loop



*Default Selection

Figure A.8
Current Minor Loop Reference

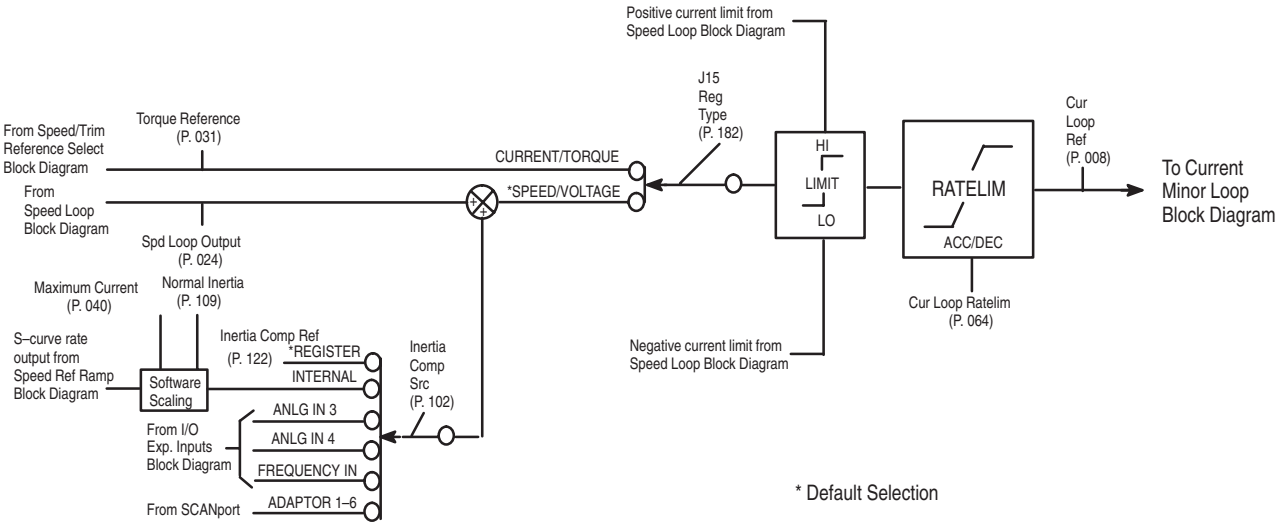


Figure A.9
Current Minor Loop

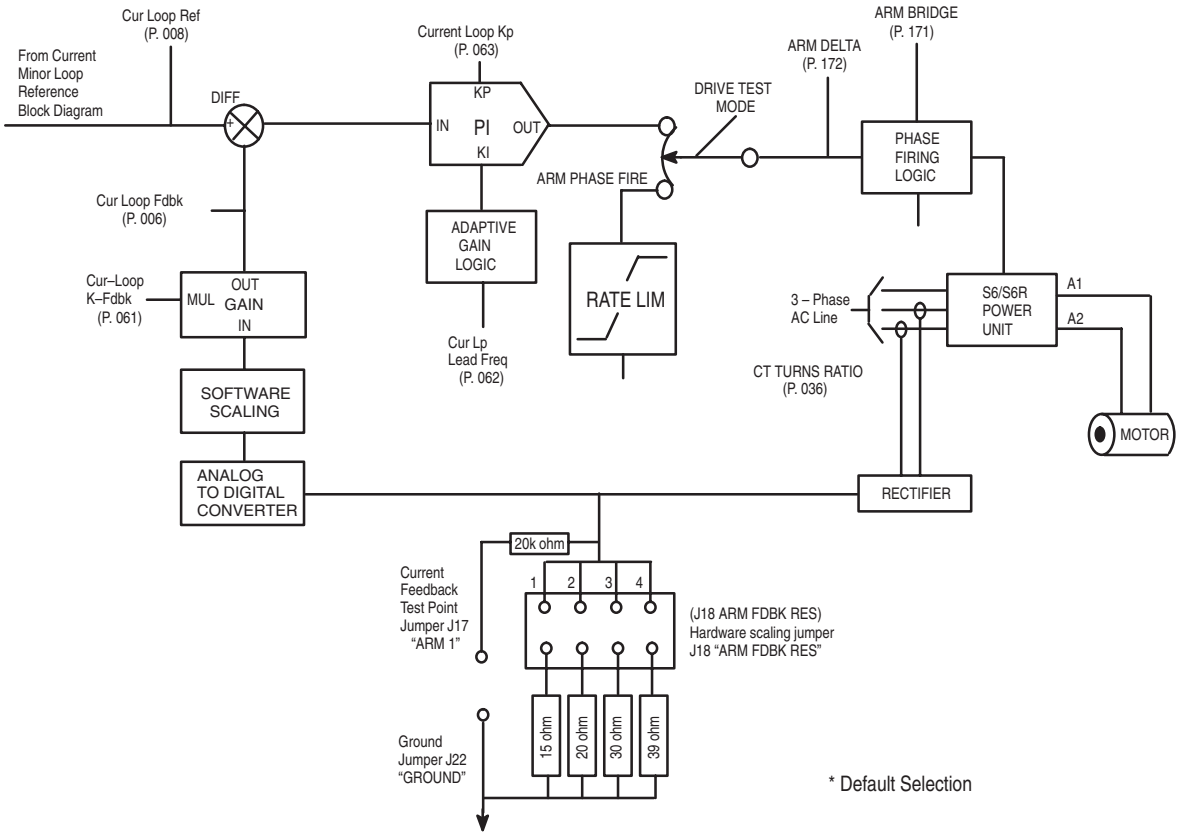
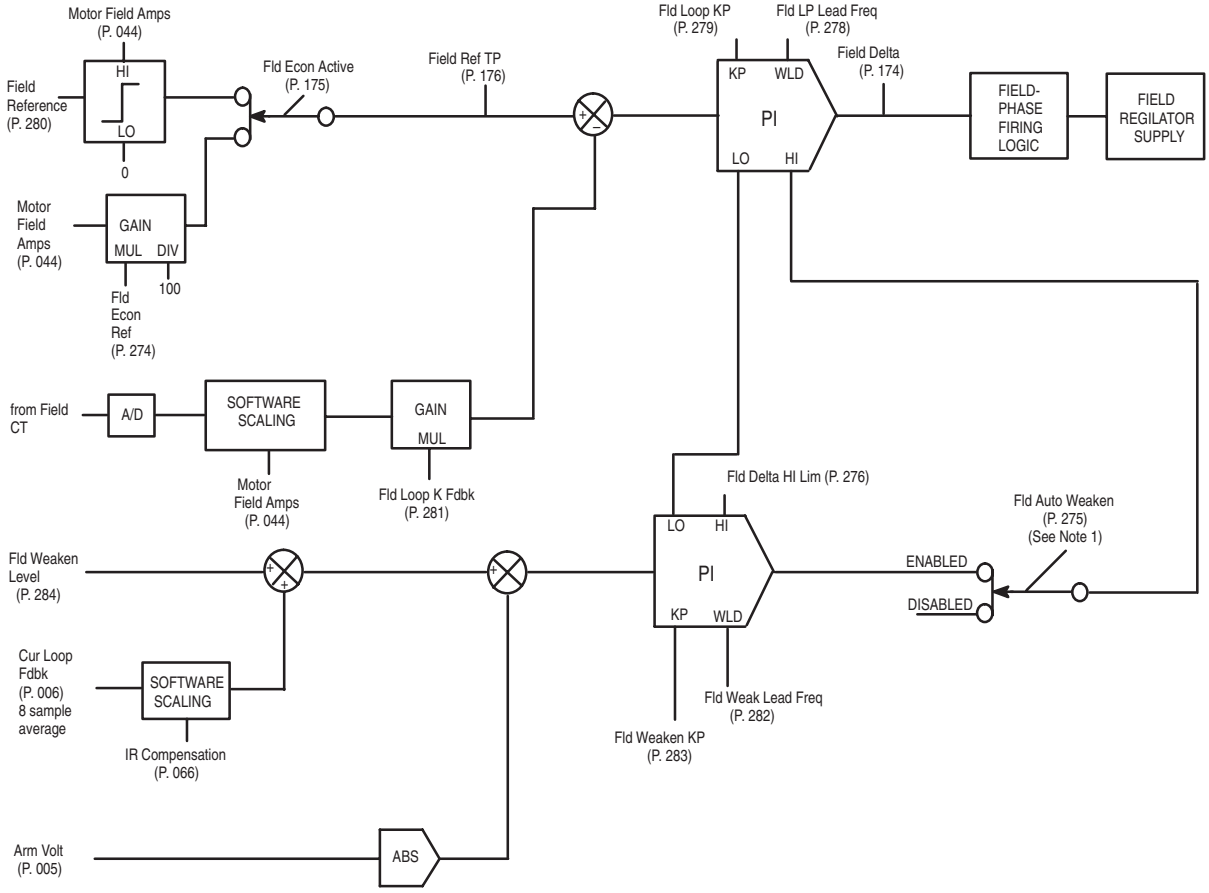


Figure A.10
Field Control Loop



NOTE 1: FIELD AUTO WEAK is clamped to DISABLED when FEEDBACK TYPE = ARM VOLT

Figure A.11
Standard Outputs

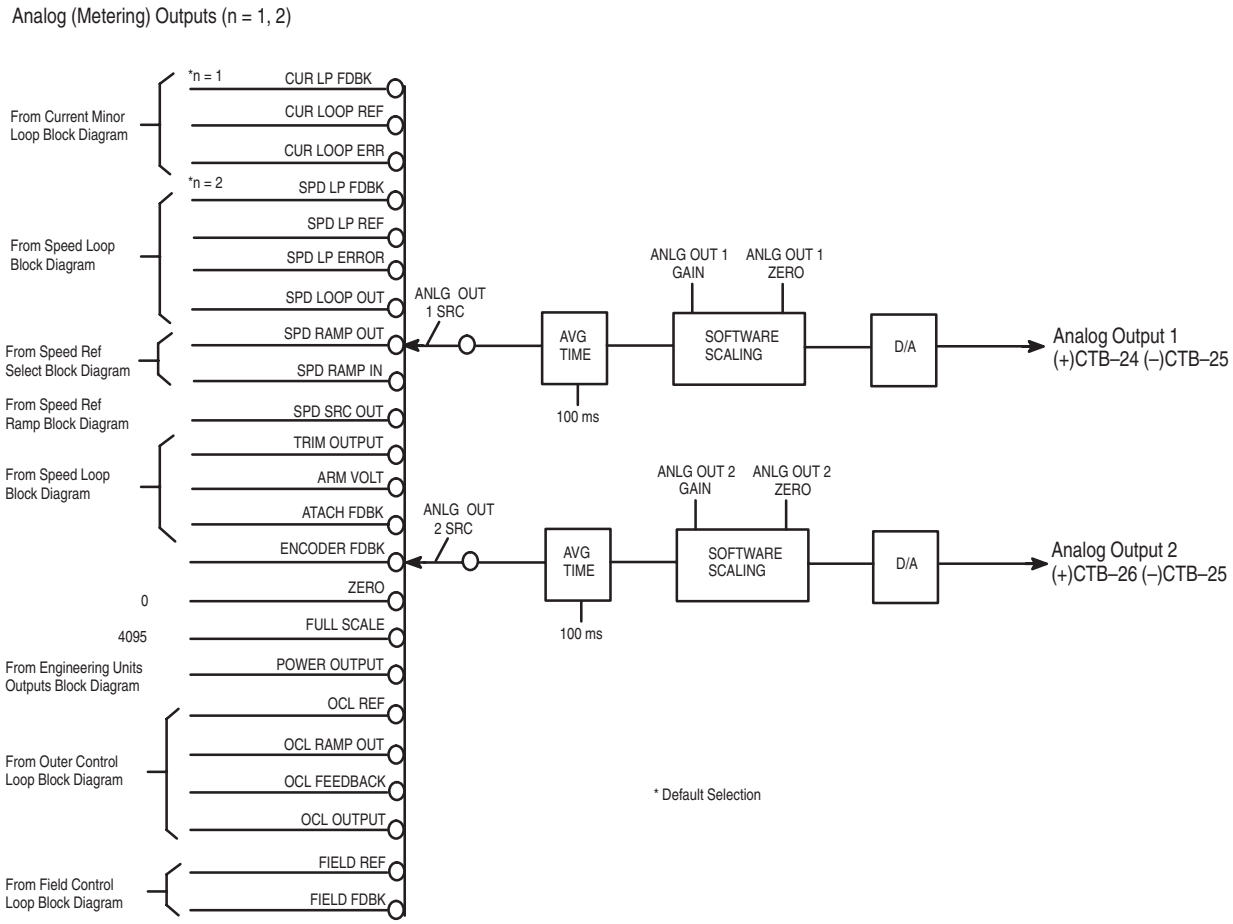
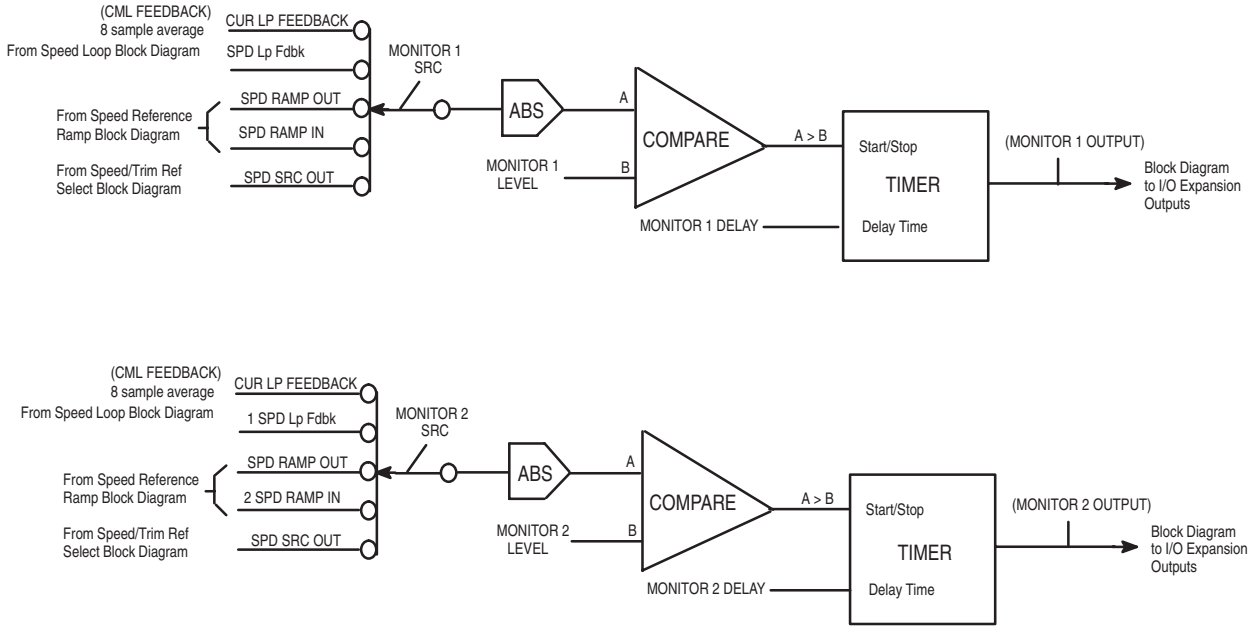
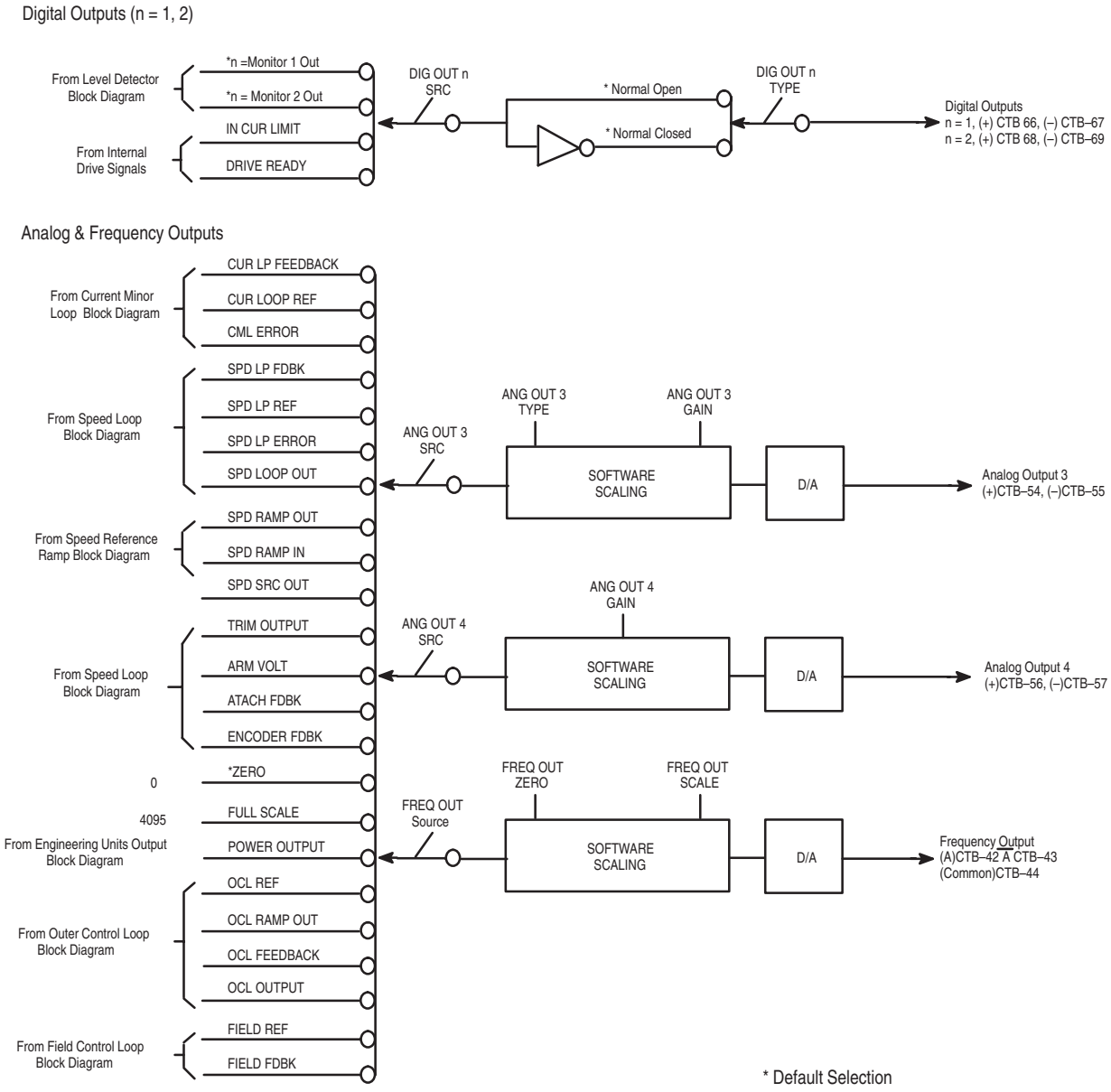


Figure A.12
Level Detectors



* Default Selection

Figure A.13
I/O Expansion Outputs



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CE Conformity

EMC Compliance

This appendix provides information on installing 1397 Drives for compliance with European Union Electromagnetic Compatibility (EMC) Standards. It covers:

- Requirements for standards compliance
- Guidelines on installing the AC mains filter and inductor
- Instructions on how the Drive must be installed, wired, and grounded for compliance. These instructions are in addition to the normal installation instructions.

  IMPORTANT: This appendix is not applicable to 1397 drives rated above 300HP @460 VAC. These higher horsepower drives are not designed to be CE-compliant.

EMC Requirements

For the 1397 Drive to conform to the standards listed on the Declaration of Conformity (DOC) above, the Drive must:

- Be accompanied by the DOC for that Drive
- Be specified by model number on the DOC
- Have a CE mark, which is below the Drive nameplate
- Be mounted and wired on the conductive, non-coated back panel of an electrical cabinet.
- Include an AC Line filter and inductor as specified in this Appendix.
- Be installed according to the instructions in this Appendix
- Be operated with the electrical cabinet doors closed.

  NOTE: Conformity of the 1397 Drive does not guarantee that the entire installation will be in conformance.

Equipment Requirements

In addition to the Drive, you will need the following to install the 1397 for CE compliance:

- Electrical cabinet with back mounting panel
- AC Line filter
- AC Line inductor

Mounting Panel and Electrical Cabinet Selection – The 1397 Drive, AC Line filter, AC Line inductor, and any other electronic or electrical equipment must be mounted in an electrical cabinet. The back mounting panel where this equipment is mounted must have a good electrically conductive surface, such as aluminized cold-roll steel, Galvalume, or galvanized steel. It must be free of any insulating coatings, such as varnish or paint. This establishes a good ground plane for the mounted equipment.

The degree of enclosure does not play a significant role in the containment of RF emissions. The cabinet can have ventilation louvers or openings for fans and filters. None of these openings however, can be located within a zone 10 inches above and below the height of the Drive, as shown in Figure B.1.

Selecting an AC Line Filter – AC line filters limit the conducted electromagnetic emissions to the AC power mains from the 1397 Drives. Tables B.A thru B.C list the 1397 Drives, full load amps, inductance, and the AC Line Filter model number required for each Drive. The inductance is the minimum input inductance for 2% impedance, assuming a 5 to 6% source impedance.

Table B.A
AC Line Filter Model Numbers 1.5 to 150HP @ 230 VAC

HP Rating	AC Full Load Amps	Minimum Inductance (in microhenries) (uH)	AC Line Filter Model Number
1.5	10	850	3DF4353
2	11	770	
3	13	650	
5	19	470	3DF4354
7.5	26	340	
10	33	255	3DF4355
15	48	175	
20	63	135	3DF4357
25	80	105	
30	94	90	
40	125	67	3DF4359
50	154	55	
60	186	45	
75	226	38	
100	307	27	
125	370	23	Two 3DF4359 filters connected in parallel
150	443	19	

Table B.B
AC Line Filter Model Numbers 8.8 – 89.7 kW @ 380VDC
2.1 – 1029 kW @ 415 VAC

Amp Rating	HP Rating	AC Full Load Amps	Minimum Inductance (in microhenries) (uH)	AC Line Filter Model Number
7	1.8	10		3DF4353
29	9	26		3DF4354
55	17.9	48		3DF4355
110	35.8	94		3DF4357
265	89.5	226		3DF4358

Table B.C
AC Line Filter Model Numbers
3 to 300HP @ 460 VAC

HP Rating	AC Full Load Amps	Minimum Inductance (in microhenries) (uH)	AC Line Filter Model Number
3	10	1680	3DF4353
5	12	1400	
7.5	15	1125	
10	18	1000	3DF4354
15	24	700	
20	31	550	3DF4355
25	39	430	
30	45	375	
40	60	270	3DF4357
50	74	225	
60	86	195	
75	110	150	3DF4359
100	143	120	
125	177	95	
150	213	80	
200	281	60	
250	351	48	Two 3DF4359 filters connected in parallel
300	421	40	

Selecting an AC Line Inductor –
IMPORTANT: A user supplied AC Line inductor must be installed between the Line filter and the AC power input of the 1397 Drive. The inductor provides the impedance required by the line filter, as shown in Table B.A, B.B or B.C. This inductor also limits the SCR line commutation notch to less than 80% when the Drive is connected to a 5% to 6% impedance source. This meets the requirements of DIN 160 Line Notching.

If the Drive is to be used in an overload condition, an inductor must be chosen that is rated for the resulting average RMS current and that will not saturate during overload.

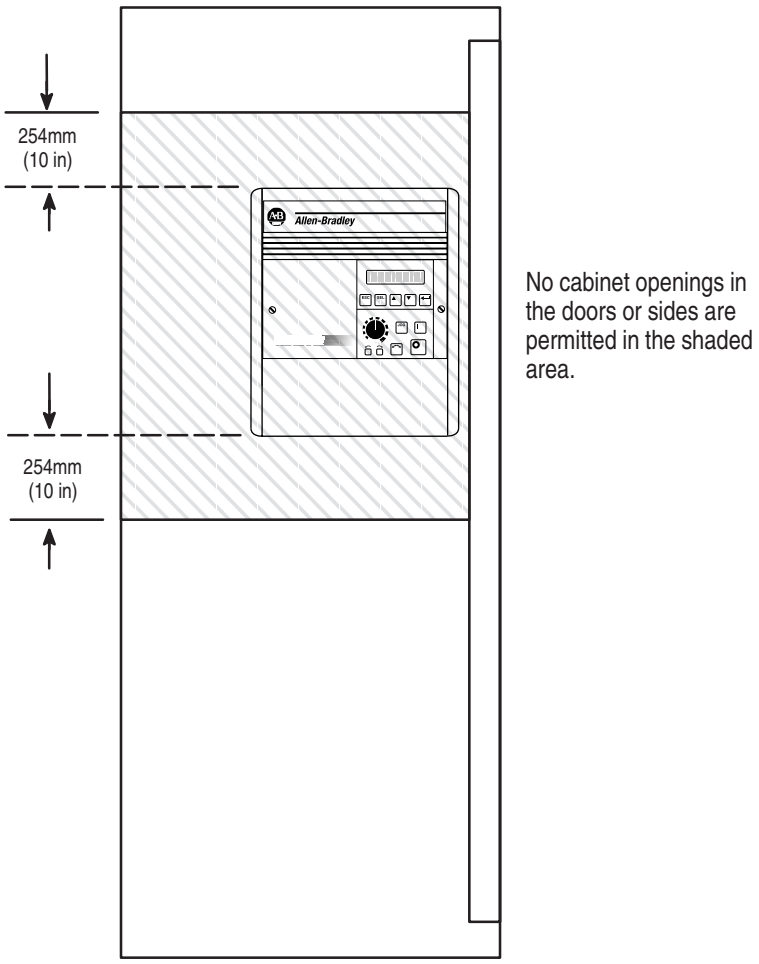
Selecting an Operator Control Station – If an operator control station is connected to the Drive, its enclosure must be conductive metal. The enclosure cover must be bonded to an internal ground point with a braided strap across the hinge. Standard industrial operator devices, such as pushbuttons, switches and meters can be used.

Mounting the Equipment

Mount all electronic and electromagnetic components, including the Drive and the line filter, firmly to the base mounting panel. The mounting panel must have good conductivity, as described in the paragraph *Selecting a Mounting Panel and Electrical Cabinet*.

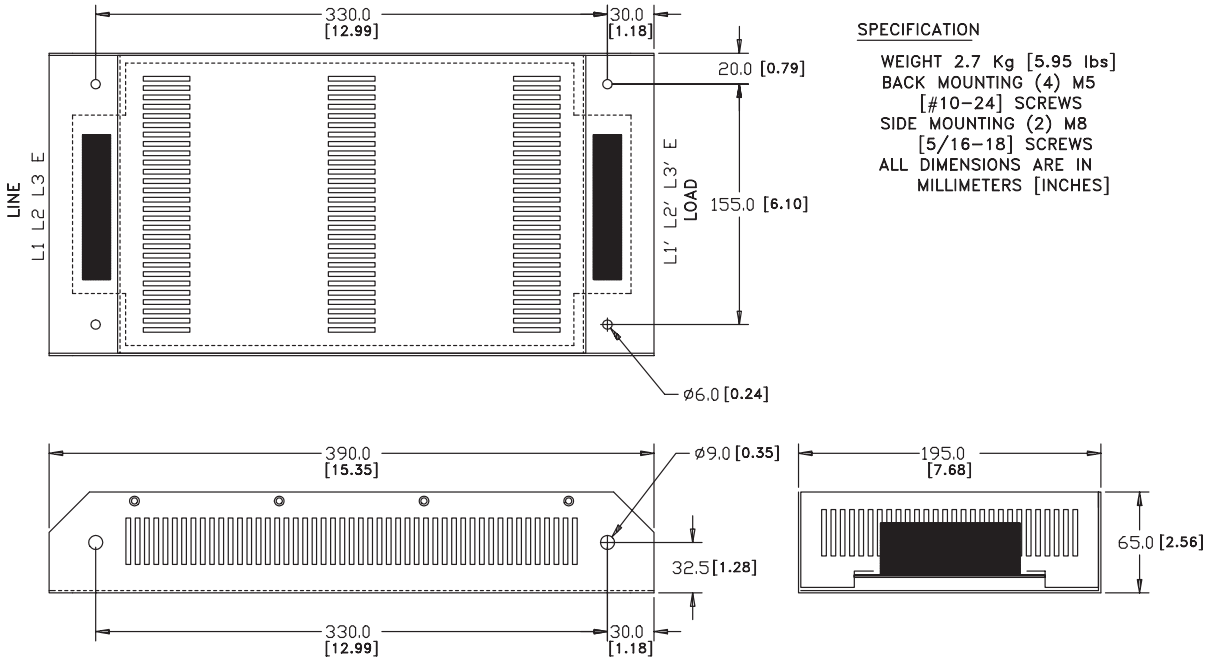
Mounting the Drive– If the cabinet includes ventilation louvers or filter and fan openings in the sides or door, the openings cannot be located within a zone 254 mm (10 inches) above and below the height of the Drive as shown in Figure B.1.

Figure B.1
Prohibited Area for Cabinet Ventilation Openings

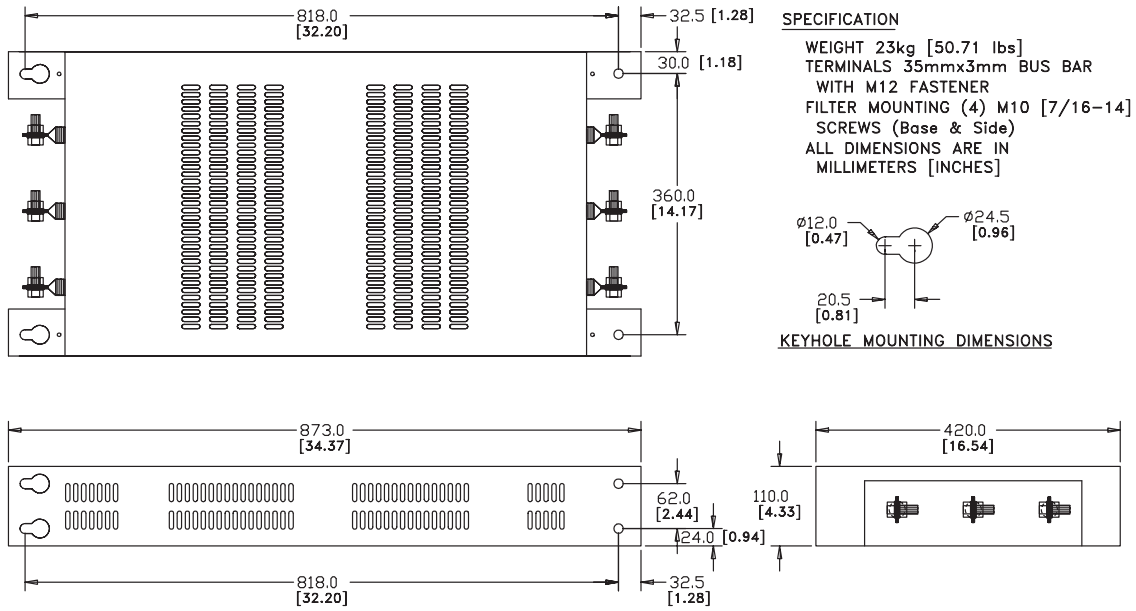


Mounting the AC Line Filter – Refer to Figures B.2 and B.3 for filter mounting dimensions. The filter can be mounted either flat, with its back against the panel, or on its side, with either side against the panel. If the 3DF4359 is mounted on its side, it must be mounted on the L bracket (included with the filter). Mount the 3DF4359 in the L bracket first, then mount the L bracket using 12mm screws.

Figure B.2
Filter Dimensions

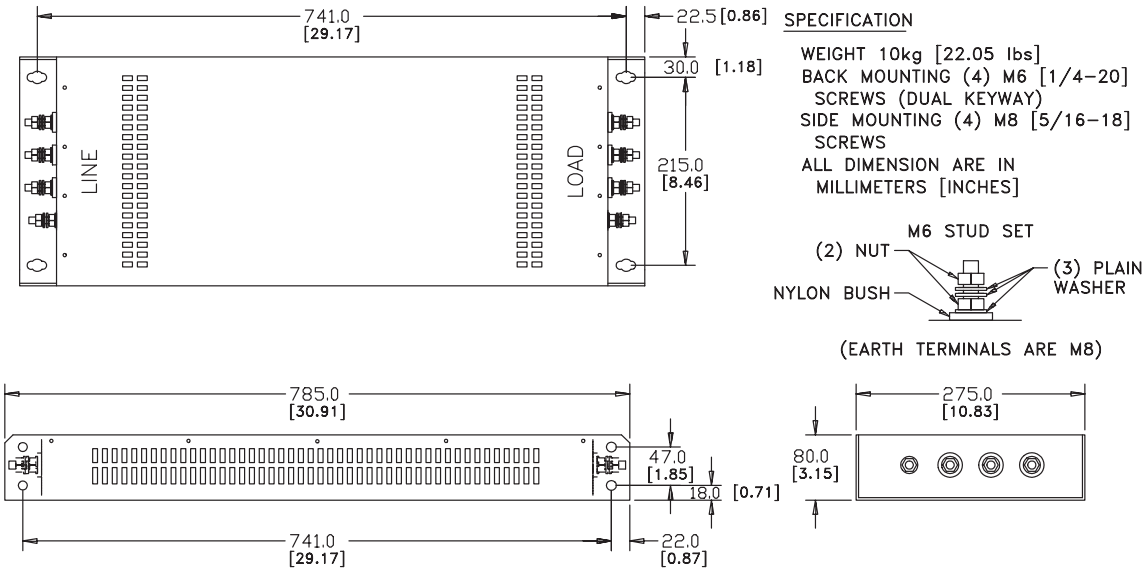


3DF4353 and 3DF4354 Filter Dimensions

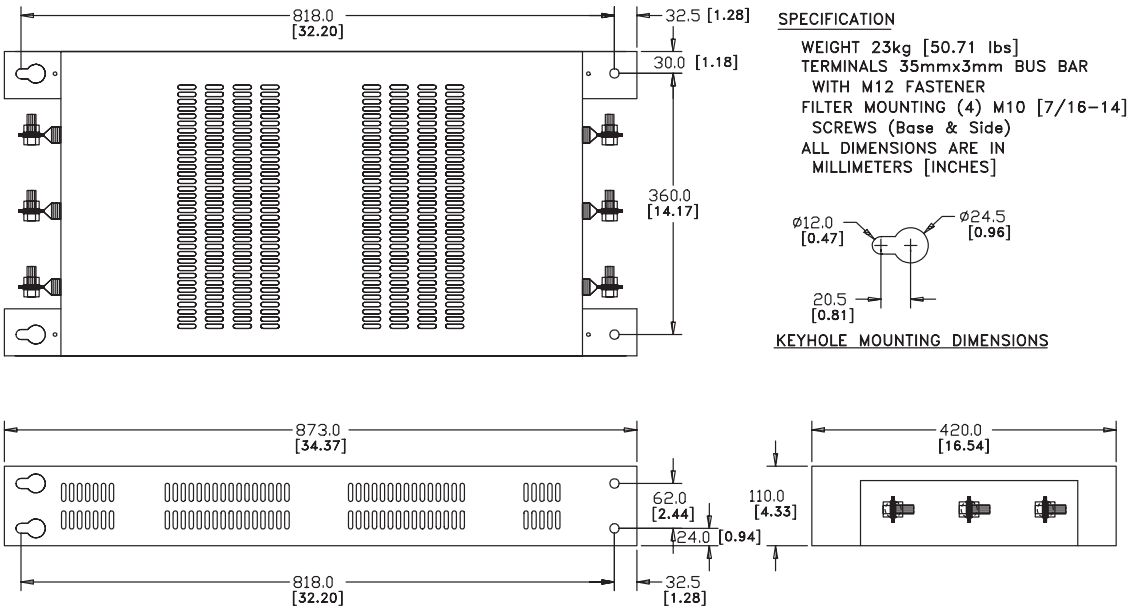


3DF4355 Filter Dimensions

Figure B.2 cont.
Filter Dimensions

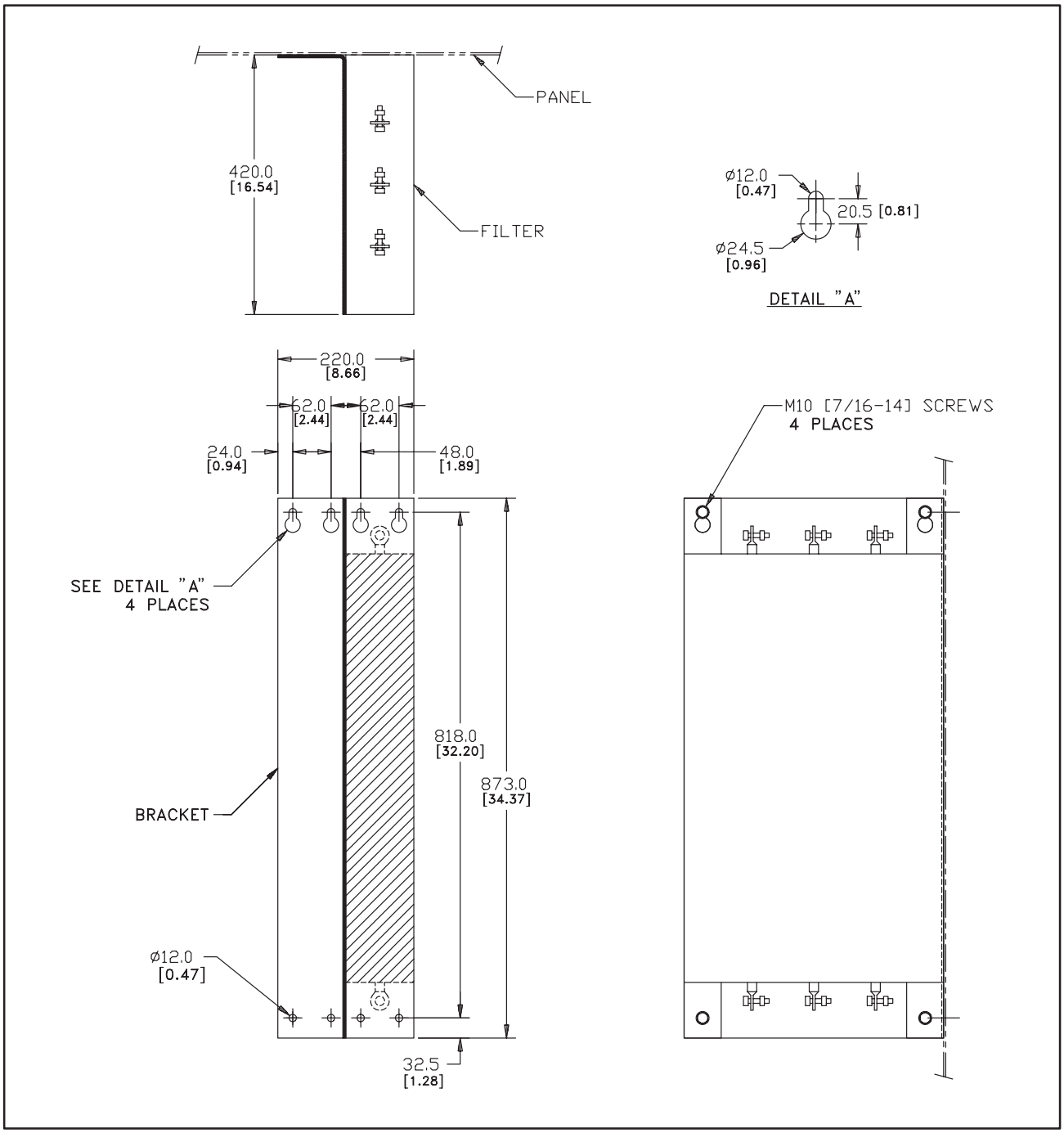


3DF4357 Filter Dimensions



3DF4359 Filter Dimensions

Figure B.3
Side Mounting the 3DF4359 Filter in the L Bracket



Mounting the AC Line Inductor – *Note: Many inductors are coated with varnish. Any varnish on the mounting area must be removed to ensure conductivity.*
See the manufacturer's documentation for additional mounting instructions.

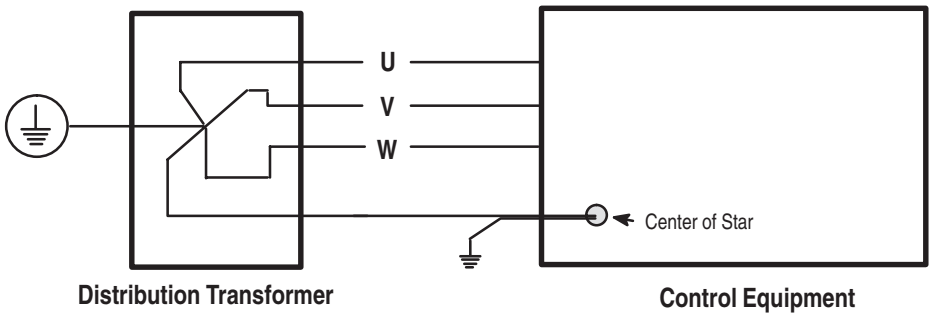
Grounding Requirements

Star grounding must be used and must provide traditional product safety grounds, such as high current, low frequency, and high frequency noise control.

System Power Ground – The common power distribution system found in European countries includes the grounded neutral of the WYE transformer, as shown in Figure B.4. This fourth wire provides the system ground for the electrical equipment and a return path for ground current. A ground terminal of adequate size for the expected ground conductor must be provided for this ground wire because it will enter the cabinet combined with the three–phase power leads.

If the power distribution ground lead is not provided, you must provide a fine-braided copper strap conductor of sufficient current capacity to handle system ground fault currents. This strap must be connected from the system ground terminal to the building's steel works.

Figure B.4
Typical European Power Distribution



Control System Ground – A star ground system must be provided. For convenience, the star ground can be extended by using copper bus bar that is at least 10 times wider than it is thick.

All electronic and electromagnetic equipment on the panel must be connected to the star system. Equipment that must be connected includes the 1397 Drive, the AC line filter, the AC line inductor, the cabinet door, and all non-welded (side and back) panels. To connect the equipment, use fine-wire braided copper strap. The strap should be at least 3.2 mm x 12.7 mm (0.125' x 0.5') with 150 strands.

Provide a convenience termination ground for the connection of the shield of shielded signal and power cables. Refer to Figures B.5 and B.6 for proper termination of shielded cables.

Figure B.5
Termination of Shielded Cables using a Termination Fitting

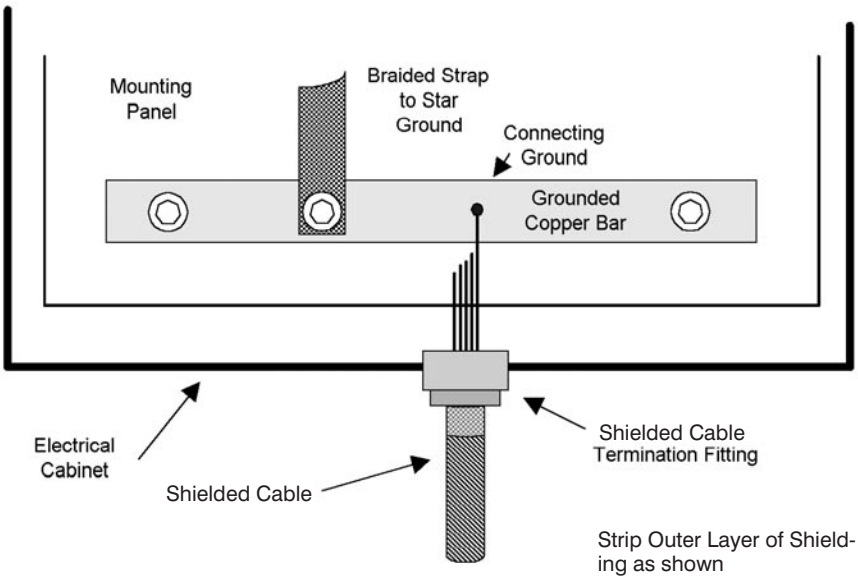
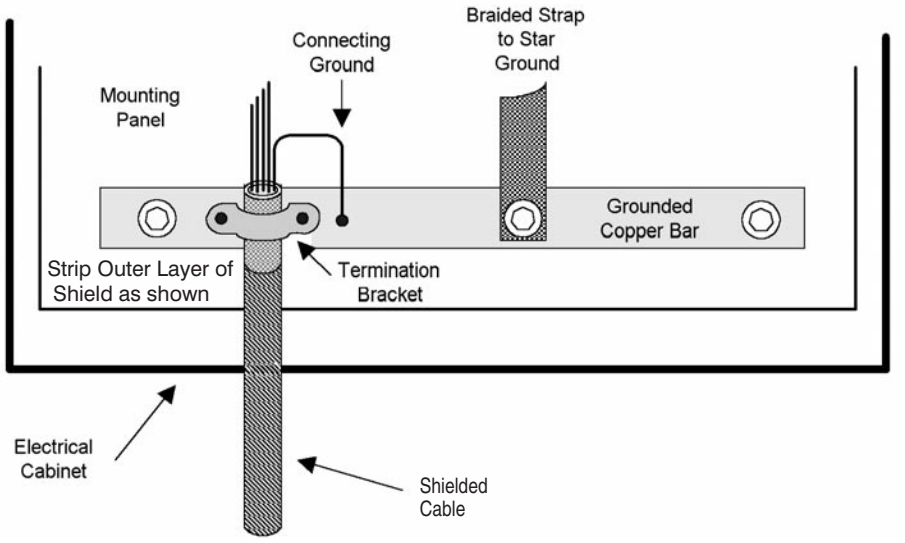


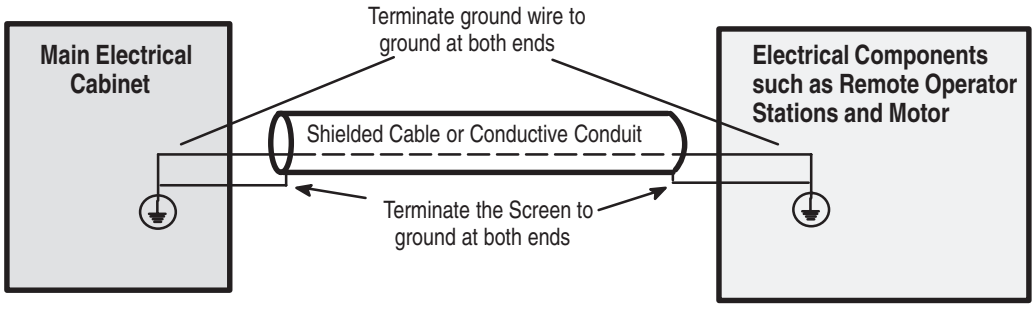
Figure B.6
Termination of Shielded Cables using a Termination Bracket



When using a conduit termination fitting to terminate the shield or rigid conduit, the area around the entry hold must be free of paint and protected from corrosion.

System ground must be extended to all connected enclosures and components by running a ground conductor with the power and signal conductors to these enclosures and components, as shown in Figure B.7. Follow the electrical cabinet guidelines described in this Appendix for all remote electrical enclosures.

Figure B.7
Ground System and Conduit Screen Termination


Terminate ground wire to ground at both ends
Main Electrical Cabinet
Electrical Components such as Remote Operator Stations and Motor
Shielded Cable or Conductive Conduit
Terminate the Screen to ground at both ends

The minimum cross–sectional area of a copper ground conductor shall be per EN60204-1: Safety of Machinery - Electrical equipment of machines - Part 1: General requirements, section 5.2, Table 1.

The ground conductor must be secured at both ends in a solid connection. Poor termination of a ground connection is the single biggest source of EMC problems. For connections, use fittings intended for solid, long–term connections to a grounded surface, or continue the screen or conduit beyond the cabinet barrier to a ground terminal or copper bar extension. Fittings should be rust resistant. It is preferred to terminate the screen or conductive conduit to a system ground copper bar internal on the back of the panel and not rely on the conduit fitting to maintain the ground circuit. Shielded cable should use a drain wire for the electrical bonding of the shield to the ground system.

Wiring the Equipment

Wiring guidelines are provided here for wiring that is external and internal to the electrical cabinet and also for specific components.

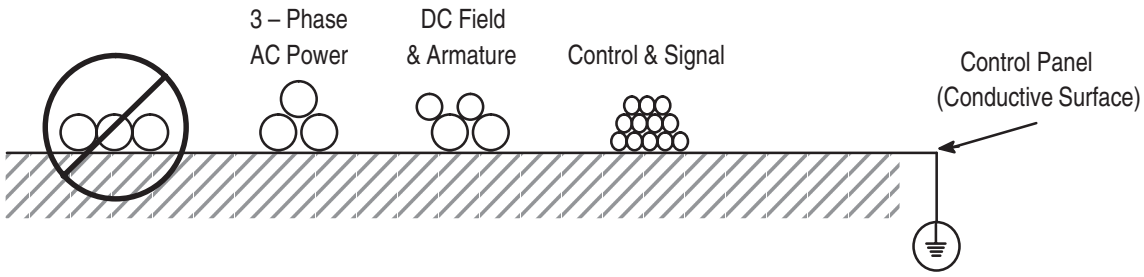
External Wiring Guidelines – External control, signal, and power wiring must be in shielded cable or rigid continuous conductive conduit.

If the system includes a remote operator station that is connected to the 1397 Drive, the operator station wiring must be in rigid continuous conductive conduit. Shielded cable cannot be used for the operator station.

NOTE: *Many flexible metal conduit products have not been designed for RF containment and are not adequate to maintain compliance.*

Internal Wiring Guidelines – All cables and wires must be run as closely to the panel as possible. AC, DC and control wires should be stacked and run as shown in Figure B.8.

Figure B.8
Dressing Power and Control Wires



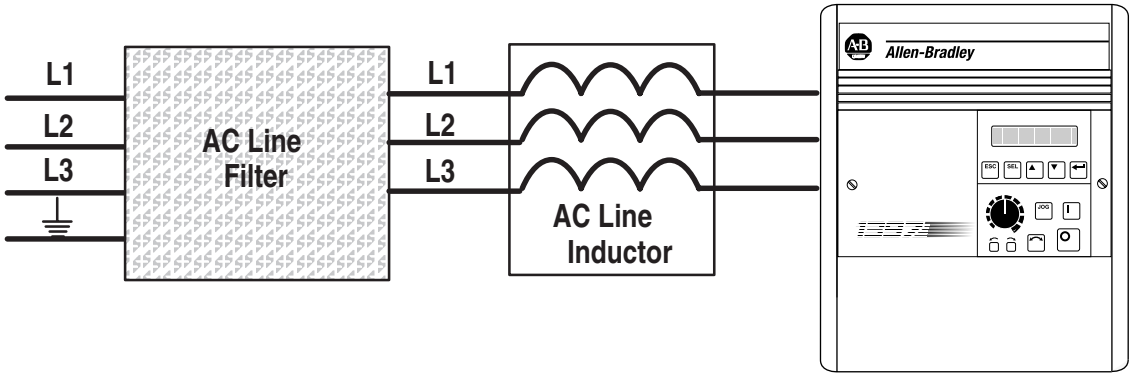
When the AC power leads must leave the ground plane of the mounting panel to make connection to elevated device terminals, a ground wire should be run with that wire bundle. Refer to Figures B.10 and B.11 for typical panel electrical layouts.

Wiring the AC Line Filter – The line filter is connected in series from the AC supply line to the AC line inductor to the input terminals in the Drive as shown in Figure B.9.

AC power wiring from the electrical cabinet power entry to the line filter must be:

- As short as possible.
- Separated from any other wiring to prevent coupling high frequency noise back to the filtered leads.
- Run as close to the ground plane as possible.

Figure B.9
AC Line Filter, Inductor and 1397 Drive



Wiring the AC Line Inductor – Install the Line Inductor between the line filter and the AC power input of the 1397 Drive as shown in Figure B.9.

Wiring the Motor – Field and armature circuit wiring that is internal to the electrical cabinet must be:

- Separated from all other wiring on the panel
- As close to the ground plane as possible. This is especially important if an inverting fault breaker or dynamic braking circuit is part of the armature circuit.

The external motor wiring must be run in a shielded cable or continuous conductive conduit. The motor shunt field and armature leads can be run together in the same cable. A ground wire must be run that bonds the motor to the system star ground. Refer to Figure B.6 for proper connection of the conduit shield and bonding wire.

Motor cable length is a major contributor to common mode conducted emissions. The 1397 mains filters are sized for up to 75 meters (250 feet) of shielded motor power cables (total installed length). If your installation requires a greater length, contact Allen-Bradley.

Wiring the Kits – The Bulletin 1397 has a number of option kits. The kits listed in Table B.D are EMC benign – they have no impact on the EMC compliance of the product if properly installed. See the appropriate kit Instruction Manuals for installation and wiring information.

Table B.D
1397 EMC – Benign Kits

Kit Name	Model Number
115 VAC Control Interface	1397 – LII
460 VAC to 230 VAC Fuse Conversion	1397 – FC
AC Line Disconnect	1397 – DS
Blower Motor Starter	1397 – MB
Enhanced Field Supply	1397 – FS3
Field Current Regulator	1397 – FS2
Inverting Fault Circuit Breaker	1397 – IFB

I/O Expansion Board (Model Number 914FK0101) – Wiring connected to this board must be run in shielded cable or continuous conductive conduit.

Dynamic Braking Kit – The Standard dynamic braking resistor kits can be installed on the top of the electrical cabinet either in an expanded sheet metal enclosure or solid plate enclosure without impact on compliance. The kit enclosure can be used for the resistors and dynamic braking circuit. The DC motor armature leads to the resistor enclosure are to be dressed close to the mounting panel as shown in Figure B.8.

Encoder Pulse and AC Tachometer Kits – The tachometer cables for these kits must be run as shielded cable or in a continuous conductive conduit. A ground wire must be run with the tachometer wires and terminated to ground at both ends. The shield or conduit must be terminated to ground as discussed above and shown in Figures 2.4 and B.7.

Figure B.10
Typical 1397 Wiring for EMC Compliance With I/O Expansion Board Installed

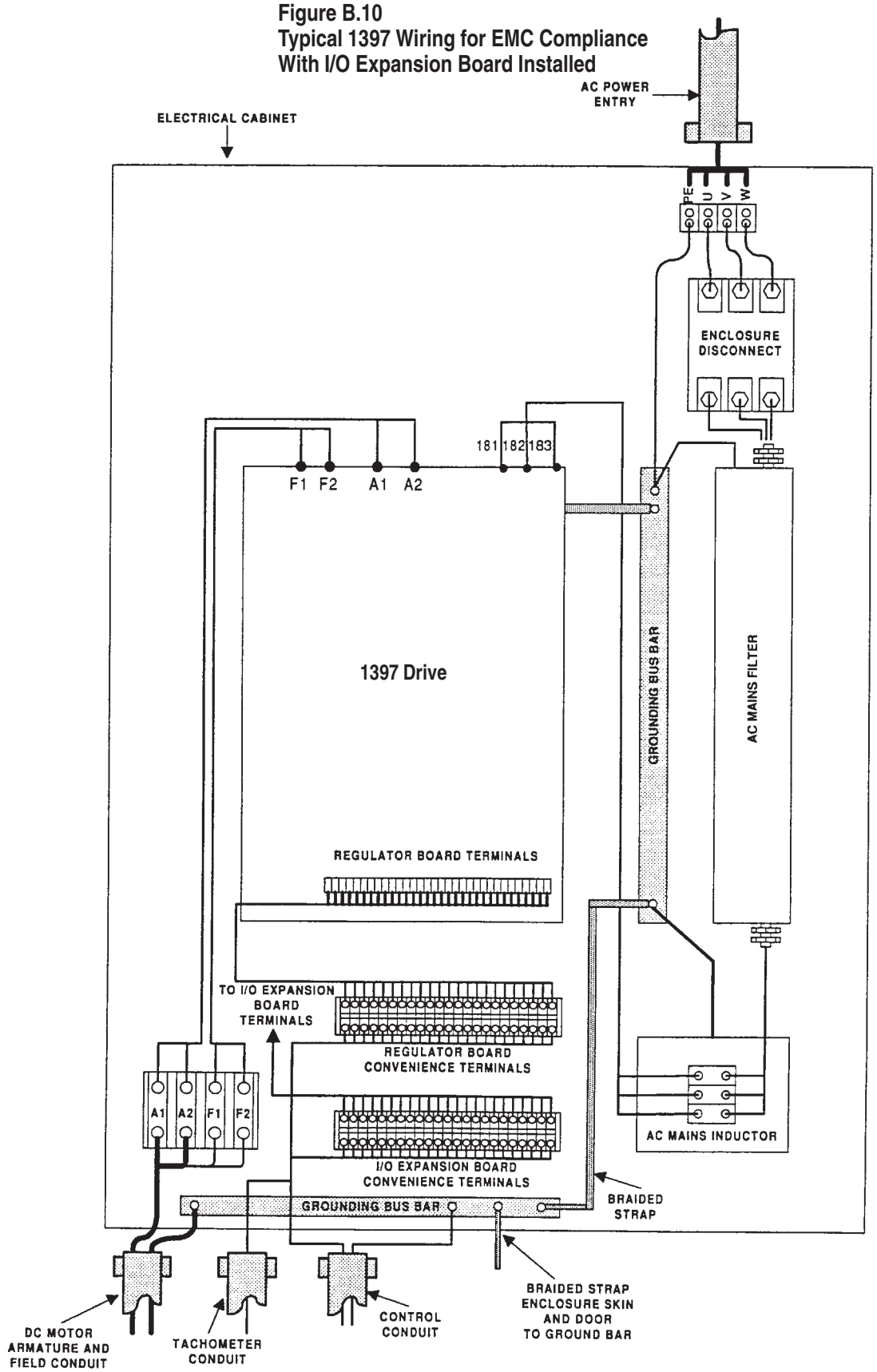
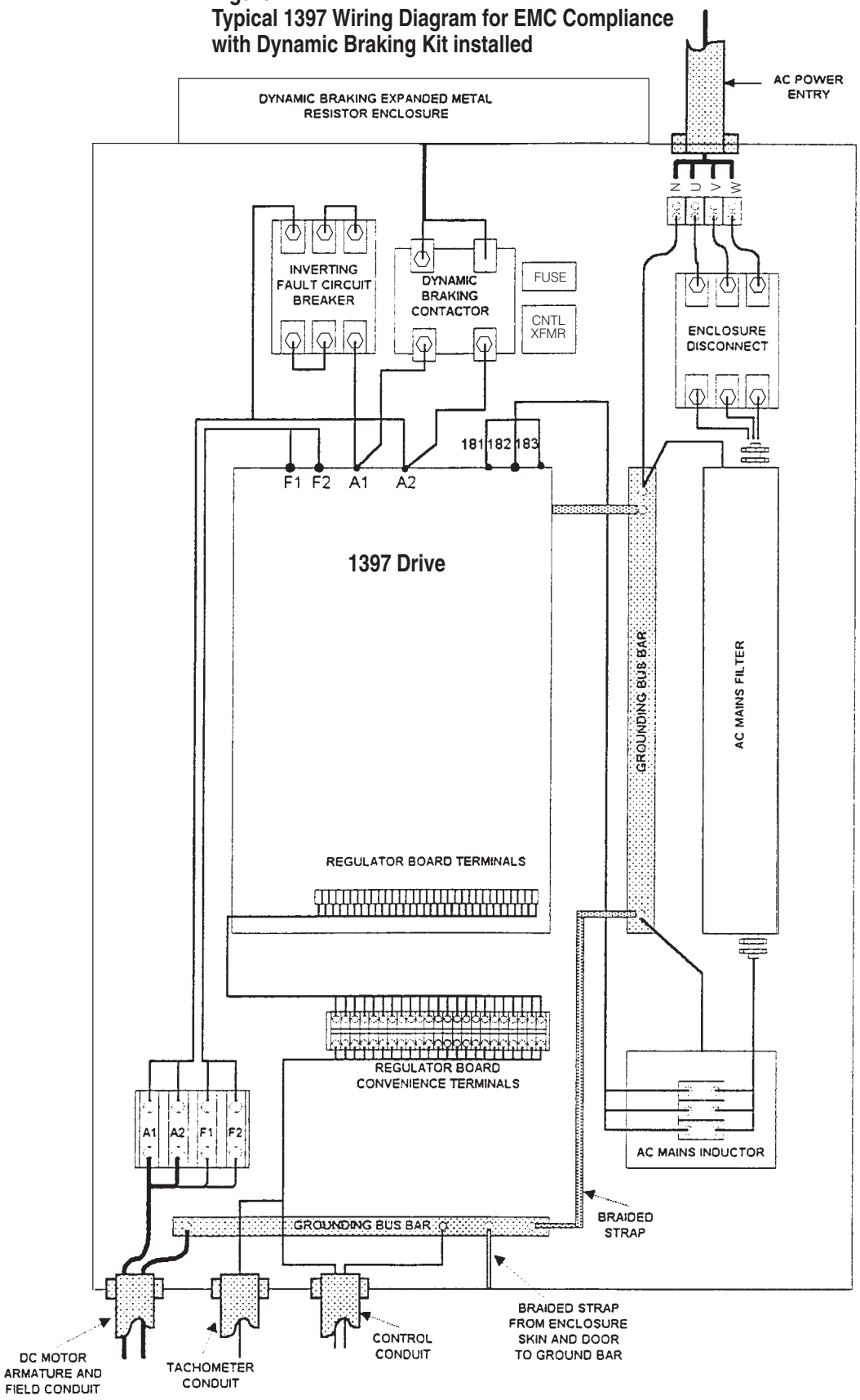


Figure B.11
Typical 1397 Wiring Diagram for EMC Compliance with Dynamic Braking Kit installed



End of Appendix

Derating

High Ambient Temperature Conditions

The watts loss values provided in Table C.A is based on 40 degree C ambient and allow a 15 degree rise to 55 degree C (internal). If your application conditions require the enclosure to be mounted in a higher than 40 degree C ambient temperature, use Table C.B to derate the cabinet heat dissipation capacity.

Table C.A
1397 Three Phase DC Drive
Heat Dissipation (Watts Loss)

HP Rating	230V	460V
5	360	403
7.5	369	409
10	420	424
15	474	432
20	523	520
25	582	547
30	635	581
40	831	626
50	1016	659
60	1090	699
75	1266	995
100	1625	1138
125	1915	1232
150	2151	1375
200		1922
250		2245
300		2479
400		4400
500		4900
600		5500

AMP Rating	380/415
7	395
29	464
55	615
110	769
265	1458
521	

Table C.B
High Ambient Temperature Derating Factors

Ambient Temperature	Correction Factor
40°C (104°F)	Cabinet heat capacity x 1
45°C (113°F)	Cabinet heat capacity x .602
50°C (122°F)	Cabinet heat capacity x .253
55°C (131°F)	Use separate ventilation

Derating for High Altitude

Altitude is also a factor in enclosure heat dissipation capability. All heat dissipation capacities in Table C.A are based on an altitude of 3300 feet (1000 meter) or less. At higher altitudes, air density, fan efficiency, and heat transfer efficiency are all decreased. Derate the heat dissipation capacity of the enclosure by 3% for each additional 1000 feet above 3300 feet.

Air Conditioning

An alternative to heat dissipation through radiation and conduction in totally-enclosed cabinets is to cool the cabinet air through air conditioning. Since air conditioners are rated in terms of BTU/HR, controller watts loss must be converted to BTU/HR. This is done by multiplying watts loss by 3.413. Use this value to select an appropriately - sized air conditioner.

Space Heaters

If space heaters are required in cold or damp environments when the Drive is not being operated, select space heaters to produce approximately one-half of the heat dissipation capacity of the enclosure.

Using SCANport Capabilities

Chapter Objectives

This appendix provides information for changing the default configuration to customize the way SCANport works for you.

This Topic	Starts on page:
Understanding the *Logic Status* parameter	D1
Configuring the SCANport controls	D3
Setting the loss of communications fault	D–5
Using the SCANport I/O image	D–5

Logic Status Parameter

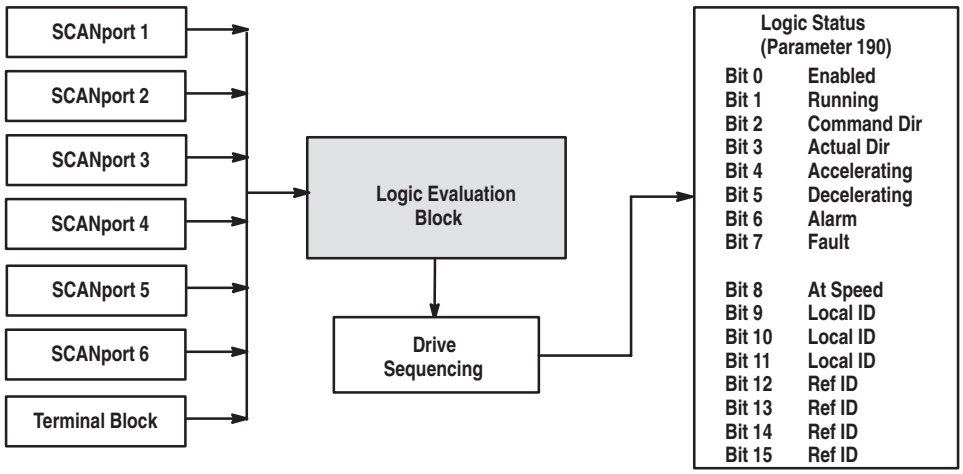
[**Logic Status**] (P. 190) on the 1397 Drive provides a record of which functions are currently executing. To use SCANport capabilities effectively, you must understand how [Logic Status] works.

[Logic Status] bits include:

BIT:	FUNCTION:		BIT:	FUNCTION:
0	Ready		8	At Speed
1	Running		9	Local I.D.
2	Command Dir		10	Local I.D.
3	Actual Dir		11	Local I.D.
4	Accelerating		12	Reference I.D.
5	Decelerating		13	Reference I.D.
6	Alarm		14	Reference I.D.
7	Fault		15	Reference I.D.

You cannot change the values shown in the Logic Status parameter by directly acccessing the parameter. Instead, the Logic Status parameter receives information from the logic evaluation block (Fig. D.1).

Figure D.1
SCANport Interaction with Logic Status

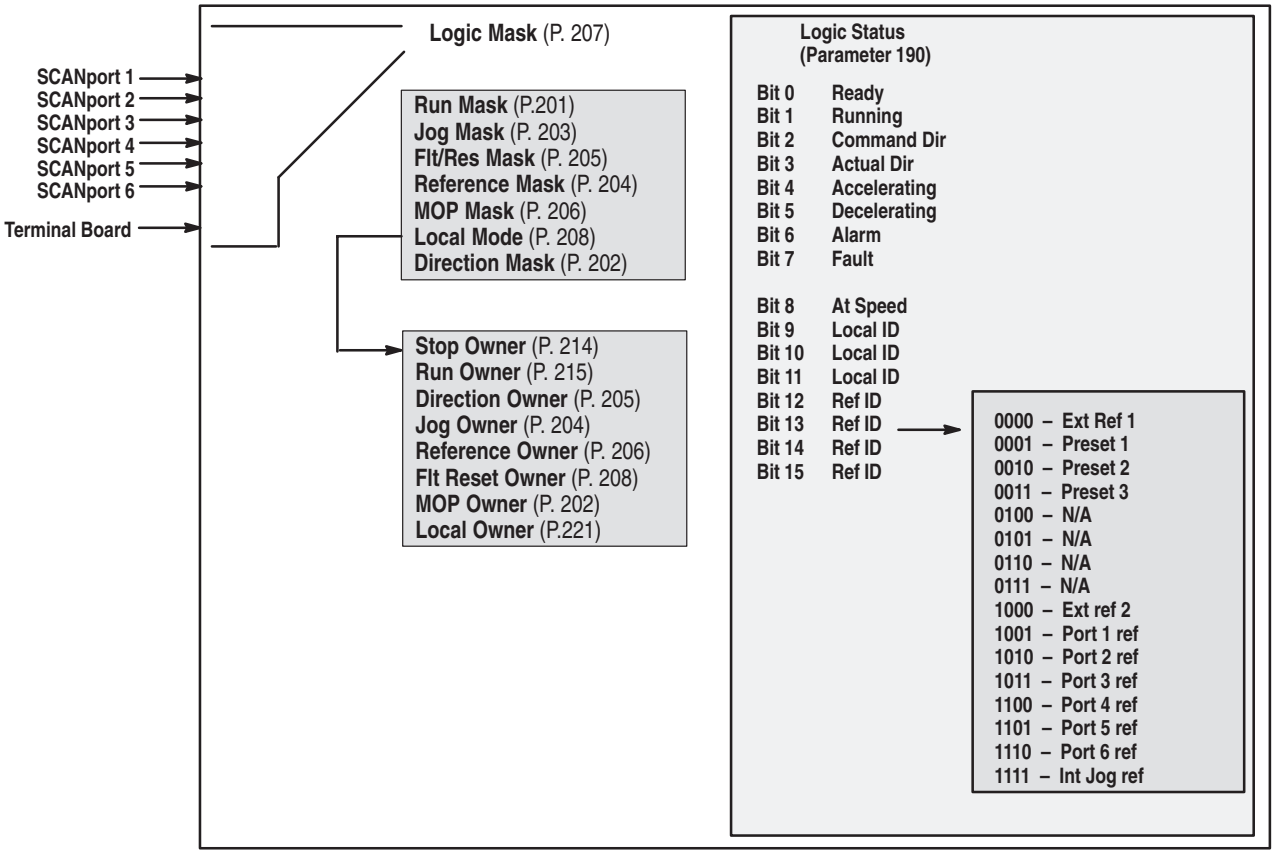


You can attach any combination of Human Interface Modules (HIMs), Graphic Programming Terminals (GPTs), and/or SCANport gateway communications modules to any of the six SCANports.

You can access ports 1 and 2 directly from the regulator board. To access ports 3, 4, and 5, you need to plug a Port Expander into port 2. Normally, port 1 is connected to a HIM. The terminal block is always present. On the 1397 Drive, there is no direct access to Port 6. However an adapter identified as 6 will still be scanned.

Figure D.2 shows the parameter interactions involved with Logic Status.

Figure D.2
Parameter Interactions



Configuring the SCANport Controls

SCANport consists of two parts: control and analog I/O. The SCANport controls are functions that control the motor, such as start, stop, and jog. The control can come from up to six SCANport devices and one Terminal Board simultaneously. The control is based on an ownership mechanism that allows certain functions to have only one owner and other functions to have multiple owners.

Control of these functions can come from only one device:	Any device can control these functions:	
Speed reference	Run	Stop
Direction	Jog	Clear Fault
Local	MOP	

Ownership is determined when a SCANport device commands a function. As long as that function is commanded, that device is the owner of that function.

For Example: If device 1 is commanding a forward direction, which is a one owner function, no other device can change the direction until device 1 stops commanding the forward direction. If device 1 is commanding a start, which is a multiple owner function. other devices can also command a start. If device 1 stops commanding the start, the Drive does not stop running if another device is still commanding the start.

A rising edge is required for start and jog functions. If a jog or start is still commanded after the Drive is stopped, start and jog functions will not operate from any device until the jog or start commands are removed.

Start commands from SCANport devices are 3 - wire (maintained) latched.

Determining Function Ownership – To determine which device is issuing a specific command, use parameters 214 through 221.

File: Program/Display ***Group***: Owners	To determine which device is issuing this command:	Check this Parameter:
Stop Owner	Stop	214
Direction Owner	Direction Owner	216
Run Owner	Run	215
Jog Owner	Jog	217
Reference Owner	Speed reference	218
Flt Reset Owner	Clear Fault	219
MOP Owner	MOP	220
Local Owner	Local	221

For each of these parameters, each bit represents a device as detailed in the following table:

If this bit is set:	The owner is:
0	Terminal Block
1	SCANport device 1
2	SCANport device 2
3	SCANport device 3
4	SCANport device 4
5	SCANport device 5
6	SCANport device 6

NOTE: Bit 7 is not used in this application.

NOTE: The SCANport device number is determined by the SCANport connection it is plugged into.

Masking Control Functions – Control functions can be masked. This allows you to enable or disable a control function for all or some of the devices.

IMPORTANT: The Stop command **CANNOT** be masked. Any device attached to the 1397 Drive can stop the Drive at any time.

To set a mask for a control function, you can use the parameters detailed in the following table:

***File*: Program/Display *Group*: Masks**	**To set a mask to control this function:**	**Check this Parameter:**
Logic Mask	Control which ports can accept the control functions	207
Direction Mask	Issue forward/reverse commands	202
Run Mask	Issue a Run command	201
Jog Mask	Issue a Jog command	203
Reference Mask	Select an alternate reference or preset speed	204
Flt Reset Mask	Generate a clear fault command	205
MOP Mask	Which adapters can issue MOP commands	206
Local Mask	Which adapters can take exclusive “local control”	208

For each of these parameters, each bit represents a device:

This bit (for low):	Represents:
0	Terminal Block
1	SCANport device 1
2	SCANport device 2
3	SCANport device 3
4	SCANport device 4
5	SCANport device 5
6	SCANport device 6

NOTE: Bit 7 is not used in this application.

NOTE: The SCANport device number is determined by the SCANport connection it is plugged into.

If a bit is clear (0) for a mask parameter, the control function is disabled. If a bit is set (1), the control function is enabled.

Setting the Loss of Communications Fault

You can specify how you want to be notified if SCANport loses the connection to a port.

If you want a communications loss to be:	Then:
Reported as a fault	Set appropriate bit in LogicMask (p. 207) corresponding to the SCANport device number or set Control Logic to enabled.
Ignored	Clear appropriate bit in Logic Mask (p. 207) corresponding to the SCANport device number, or set Control Logic disabled.

The following table specifies which bit represents a device:

To specify this device:	Set this bit:
SCANport device 1	1
SCANport device 2	2
SCANport device 3	3
SCANport device 4	4
SCANport device 5	5
SCANport device 6	6

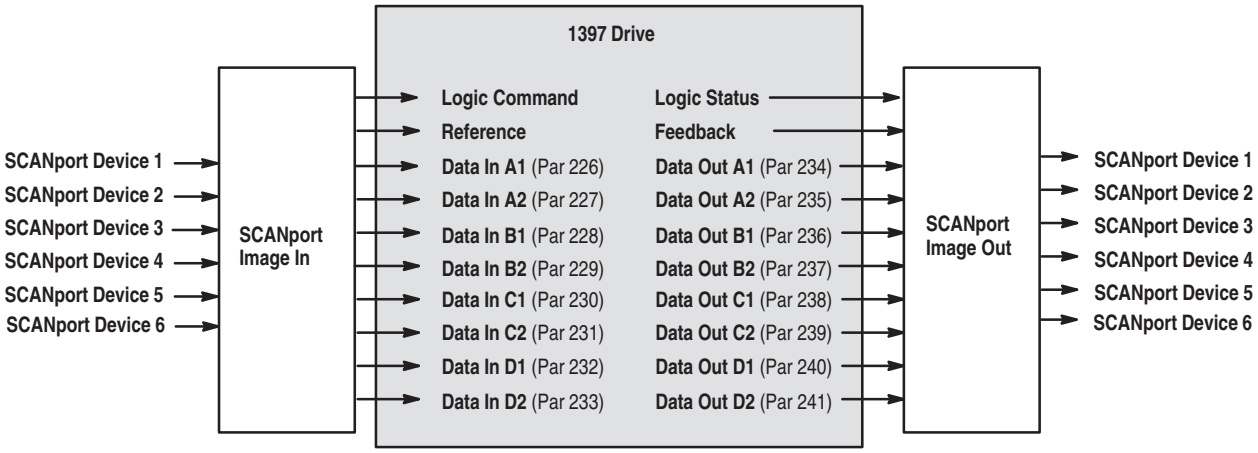
For Example: If you want a fault condition reported when communication is lost with device 3, you need to set bit 3 of Logic Mask.

NOTE: When a device is configured to NOT cause a fault upon disconnection, this device cannot control any functions in the Drive.

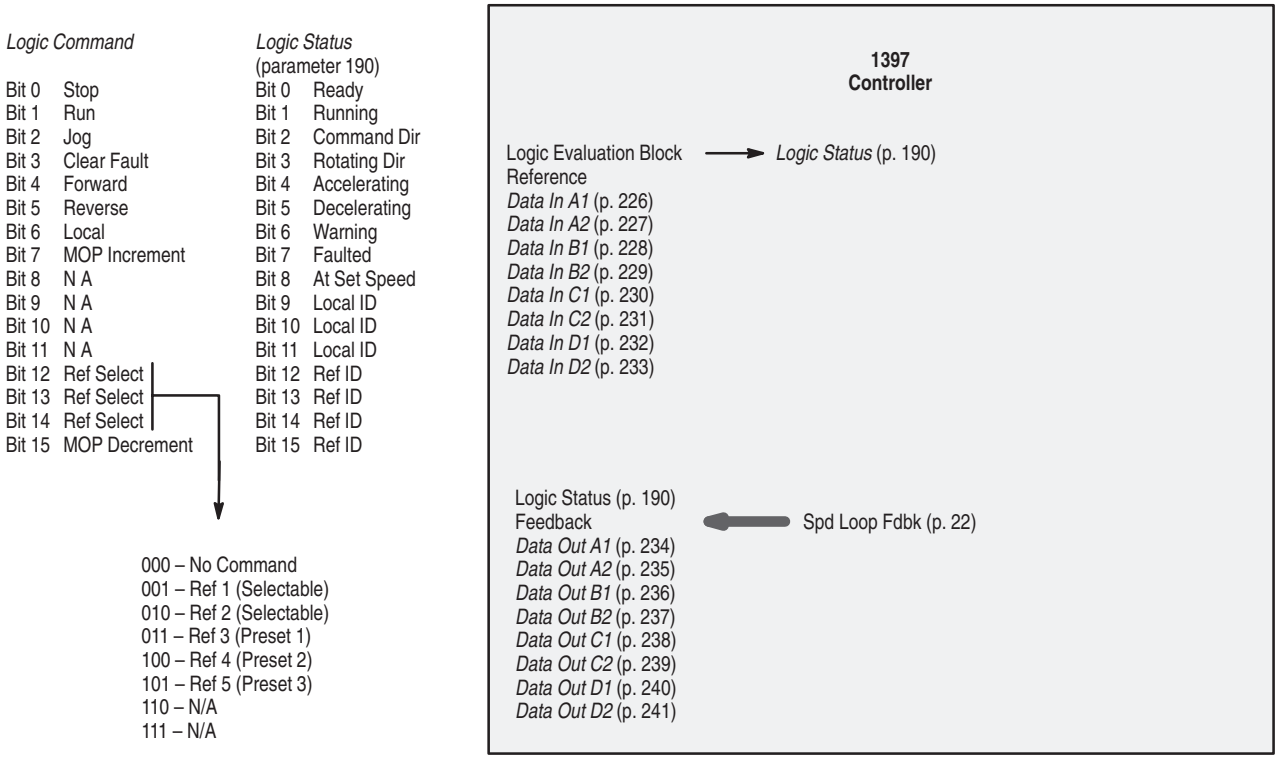
Using the SCANport I/O Image

The SCANport I/O image provides the interface between the SCANport devices and the Drive. The SCANport I/O image is used to transfer realtime data in the same way as the PLC image is used. The devices on SCANport allocate the SCANport I/O image so multiple devices can use different sections of the image.

To view the values in the I/O image table, use parameters 226 through 233 for input and 234 through 241 for output.



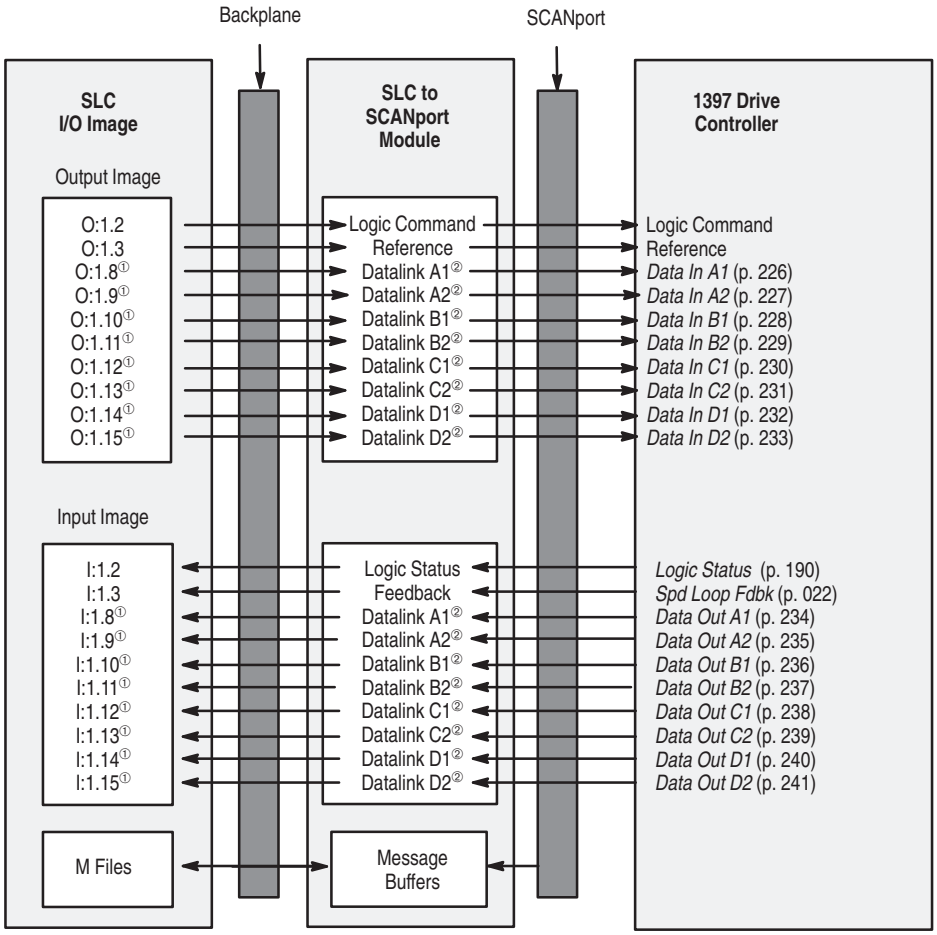
Within the 1397 Drive, the I/O image table resembles the following:



The following examples are provided to show how the 1397 Drive interfaces with some of the available adapters. These are only examples. You should also refer to the appropriate manual for your gateway for additional information.

SLC to SCANport Module:

The following figure shows how the I/O image table for the SLC programmable controller relates to the 1397 Drive. In this example, the Drive is connected to channel 1 of the SLC module in enhanced mode. If this were an example of basic mode, only the O:1.2, O:1.3, I:1.2, and I:1.3 entries would be used.

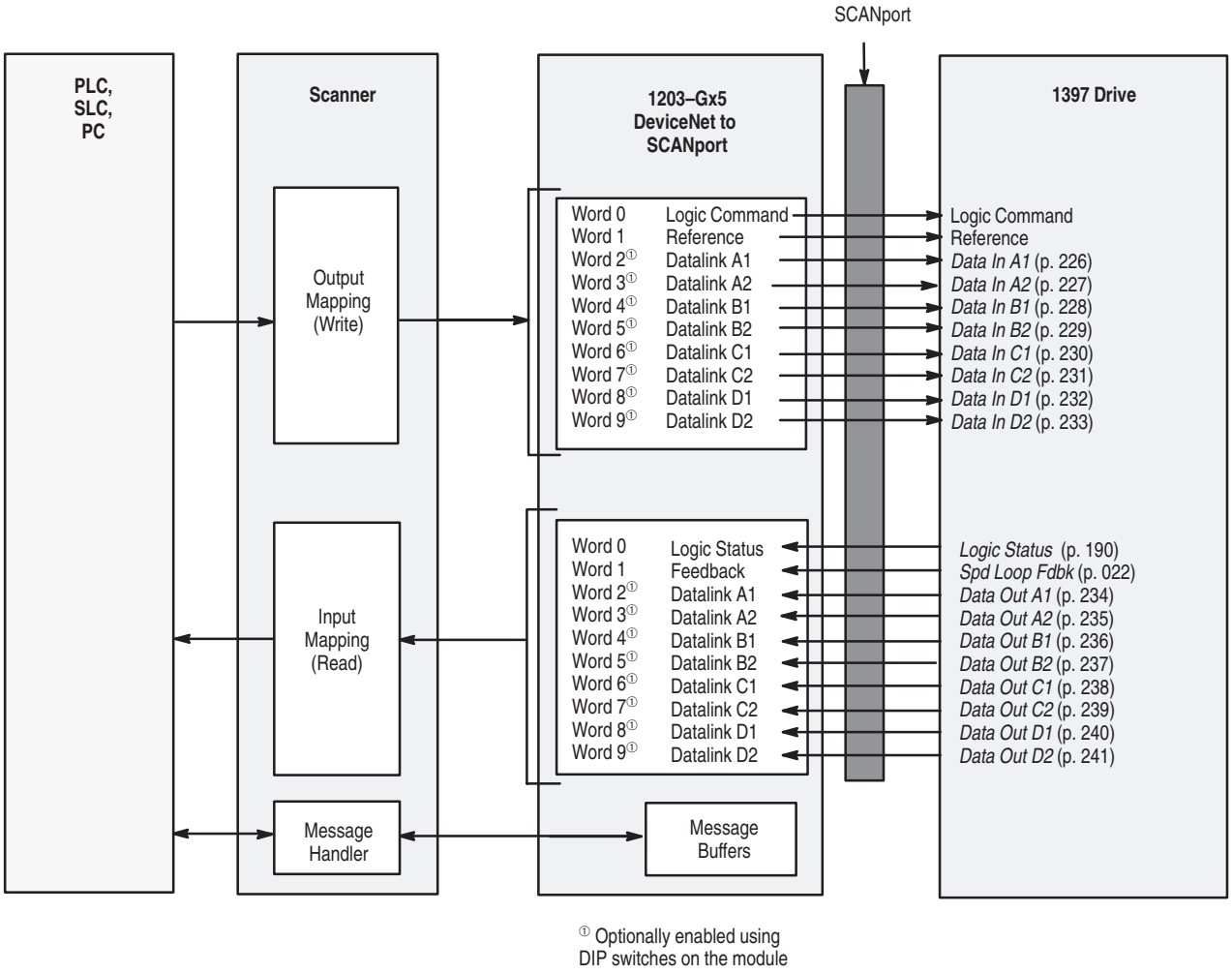


① Available only in enhanced mode.

② Optionally enabled via G file in SLC processor.

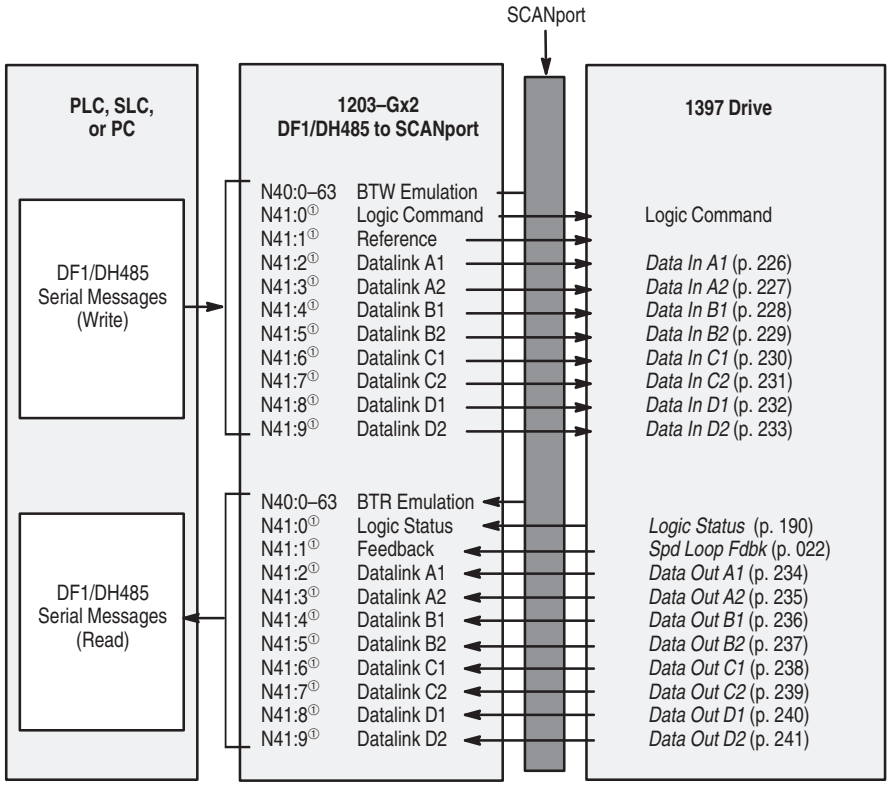
DeviceNet Communications Module:

The following figure shows how the I/O image table for a DeviceNet scanner relates to the 1397 Drive when a DeviceNet Communications Module is used.


SCANport
PLC, SLC, PC
Scanner
1203–Gx5 DeviceNet to SCANport
1397 Drive
Output Mapping (Write)
Input Mapping (Read)
Message Handler
Message Buffers
Word 0 Logic Command
Word 1 Reference
Word 2① Datalink A1
Word 3① Datalink A2
Word 4① Datalink B1
Word 5① Datalink B2
Word 6① Datalink C1
Word 7① Datalink C2
Word 8① Datalink D1
Word 9① Datalink D2
Logic Command
Reference
Data In A1 (p. 226)
Data In A2 (p. 227)
Data In B1 (p. 228)
Data In B2 (p. 229)
Data In C1 (p. 230)
Data In C2 (p. 231)
Data In D1 (p. 232)
Data In D2 (p. 233)
Word 0 Logic Status
Word 1 Feedback
Word 2① Datalink A1
Word 3① Datalink A2
Word 4① Datalink B1
Word 5① Datalink B2
Word 6① Datalink C1
Word 7① Datalink C2
Word 8① Datalink D1
Word 9① Datalink D2
Logic Status (p. 190)
Spd Loop Fdbk (p. 022)
Data Out A1 (p. 234)
Data Out A2 (p. 235)
Data Out B1 (p. 236)
Data Out B2 (p. 237)
Data Out C1 (p. 238)
Data Out C2 (p. 239)
Data Out D1 (p. 240)
Data Out D2 (p. 241)
① Optionally enabled using DIP switches on the module

Serial Communications Module:

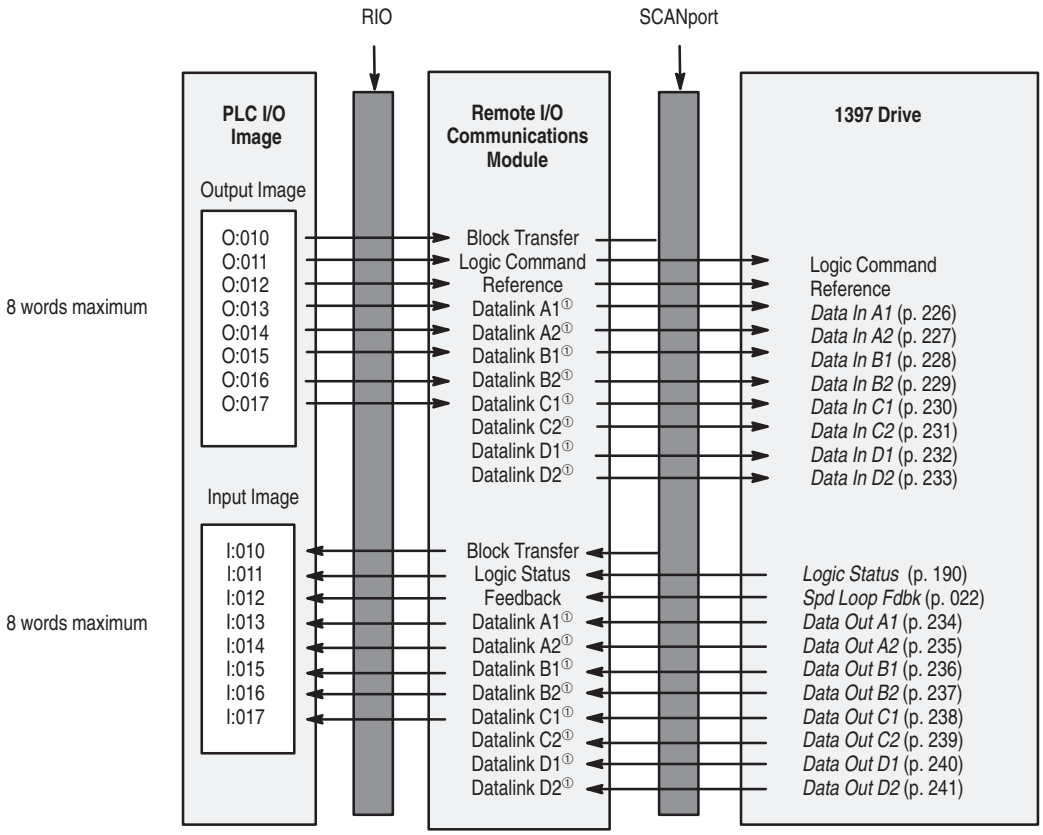
The following figure shows how the I/O image table for the programmable controller relates to the 1397 Drive when a Serial Communications Module is used.



① Optionally enabled using DIP switches on the adapter.

Remote I/O Communications Module:

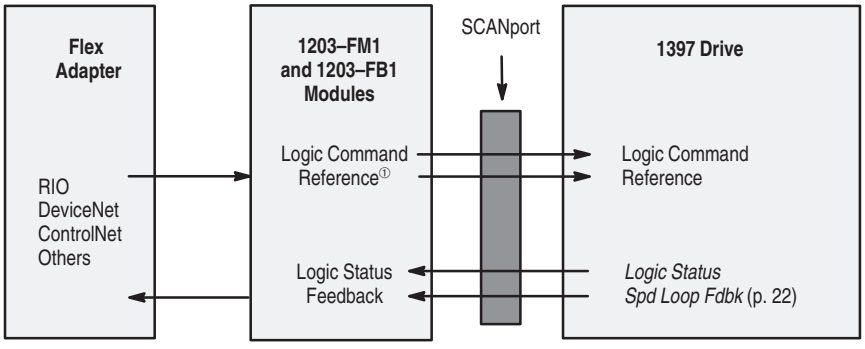
The following figure shows how the I/O image table for the programmable controller relates to the 1397 Drive when a Remote I/O Communications Module is used.



① Optionally enabled using DIP switches on the module.

Flex I/O Module:

The following figure shows how the I/O image table for the programmable controller relates to the 1397 Drive when a Flex I/O Module is used.

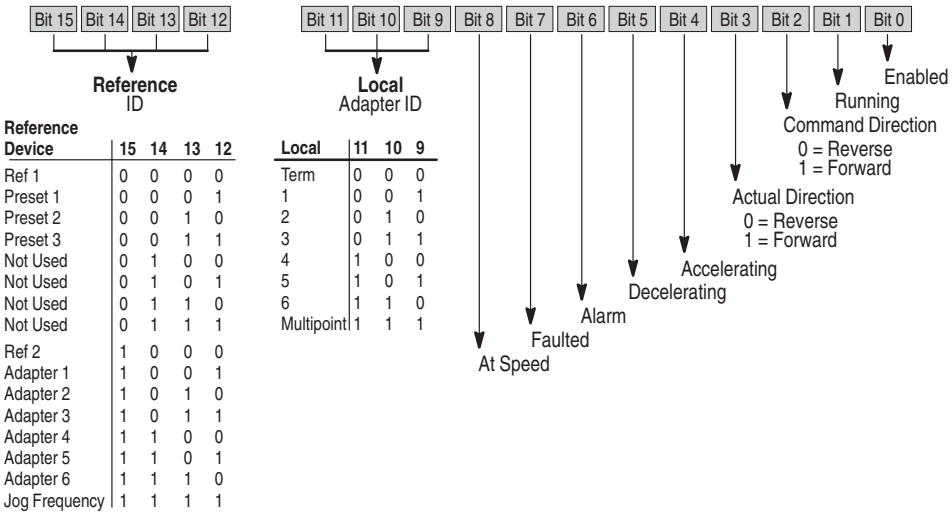


Supported SCANport Messages:

The 1397 Drive supports the following SCANport messages. The formats and methods to use these messages vary depending on the type of gateway used. Not all gateways support messaging or all message types. Consult your gateway manual(s) or application notes when determining the level for any gateway.

This Message:	Lets you:
Scattered Parameter Value Read	Read a scattered list of parameters
Scattered Parameter Value Write	Write to a scattered list of parameters and return the status of each parameter.
Read Product Number	Request the product number from a device
Product Text String Read	Request the product text from a device
Last Parameter Number Read	Request the last parameter number
EE Command Write	Activate the specified EE function
Read Full Parameter	Request all known attributes for the requested parameters
Parameter Value Read	Request the value for a specific parameter
Parameter Value Write	Write a value to a specific parameter
Fault Command Write	Clear faults, clear the fault queue, and reset
Fault Queue Size	Read the number of fault entries allowed in the fault fault queue
Trip Fault Read	Request which fault queue entry caused the drive to trip
Fault Queue Entry Read Full	Read the contents of the specified fault queue entry
Warning Command Write	Clear faults and clear the warning queue
Warning Queue Size	Read the number of fault entries allowed in the warning queue
Warning Queue Entry Read Full	Read the contents of the specified warning queue entry.

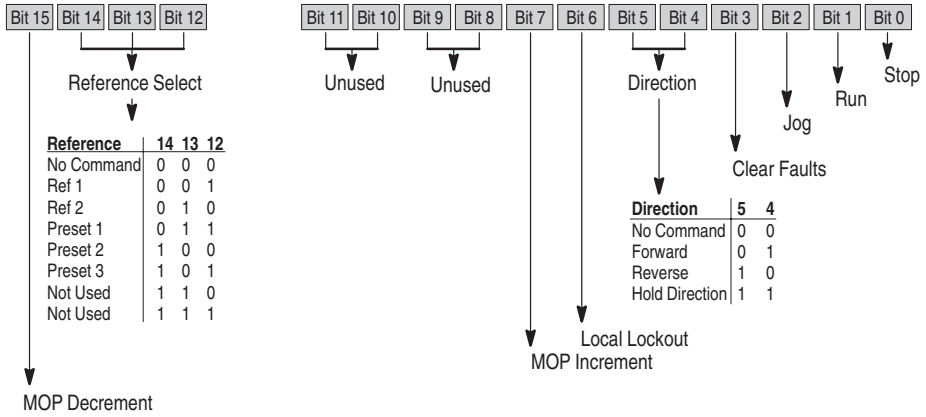
LOGIC STATUS FORMAT



Reference Device	15	14	13	12
Ref 1	0	0	0	0
Preset 1	0	0	0	1
Preset 2	0	0	1	0
Preset 3	0	0	1	1
Not Used	0	1	0	0
Not Used	0	1	0	1
Not Used	0	1	1	0
Not Used	0	1	1	1
Ref 2	1	0	0	0
Adapter 1	1	0	0	1
Adapter 2	1	0	1	0
Adapter 3	1	0	1	1
Adapter 4	1	1	0	0
Adapter 5	1	1	0	1
Adapter 6	1	1	1	0
Jog Frequency	1	1	1	1

Local	11	10	9
Term	0	0	0
1	0	0	1
2	0	1	0
3	0	1	1
4	1	0	0
5	1	0	1
6	1	1	0
Multipoint	1	1	1

LOGIC COMMAND FORMAT



Reference	14	13	12
No Command	0	0	0
Ref 1	0	0	1
Ref 2	0	1	0
Preset 1	0	1	1
Preset 2	1	0	0
Preset 3	1	0	1
Not Used	1	1	0
Not Used	1	1	1

Direction	5	4
No Command	0	0
Forward	0	1
Reverse	1	0
Hold Direction	1	1

User Parameter Values

Use the tables on the following pages to record your particular parameter value setting for the current application.

No.	Name	Default	Value	No.	Name	Default	Value
1	Anlg In 1	0		40	Maximum Current	150%	
2	Anlg In 2	0		41	Max Motor Speed	500	
3	Anlg In 3	0		42	Max Process Speed	500	
4	Anlg In 4	0		43	Min Process Speed	250	
5	Armature Voltage	0		44	Motor Field Amps	0.01	
6	Cur Loop Fdbk	0		45	Motor Arm Amps	8	
7	Cur Loop Error	0		46	Motor Arm Volts	240	
8	Cur Loop Ref	0		47	Anlg Tach V/100	18.0 V	
9	Draw Percent Out	0		48	Encoder PPR	18	
10	Field Feedback	0		49	Encoder Quad	On	
11	Frequency In	0		50	Nominal AC Freq	50 or 60 Hz	
12	Jog Ramp Output	0		51	Nominal AC Volts	230 VAC	
13	Monitor 1 Output	1		52	Auto Tune Type		
14	Monitor 2 Output			53	*Future Use*		
15	MOP Output	0		54	*Future Use*		
16	OCL Enable TP	1		55	*Future Use*		
17	OCL Feedback	0		56	*Future Use*		
18	OCL Output	0		57	Anlg Tach Gain	1.000	
19	OCL Ramp Output	0		58	Anlg Tach Zero	0	
20	OCL Reference TP	0		59	Arm Voltage Gain	1.0	
21	Spd Loop Error	0		60	Arm Voltage Zero	0	
22	Spd Loop Fdbk	0		61	Cur Loop K–Fdbk	1.00	
23	Spd Loop Lag Out	0		62	Cur Lp Lead Freq	100	
24	Spd Loop Output	0		63	Cur Loop Kp	0.250	
25	Spd Loop Ref	0		64	Cur Loop Rate Lim	40	
26	Spd Src Output	0		65	*Future Use*		
27	Spd Ramp In TP	0		66	IR Compensation	0%	
28	Spd Ramp Output	0		67	Pos Cur Lim	150%	
29	Speed Pot	0		68	Neg Cur Lim	150%	
30	Trim Output	0		69	Pos Cur Lim Src	Register	
31	Torque Reference	0		70	Neg Cur Lim Src	Register	
32	*Future Use*			71	PLL Max Error	2	
33	*Future Use*			72	Spd Lead Lag Freq	1.00	
34	*Future Use*			73	Lead Lag Ratio	2	
35	*Future Use*			74	Spd Lead Lag Type	Bypass	
36	CT Turns Ratio	32767		75	Spd Lp Lag Freq	3.00	
37	Accel Time	50		76	Spd Lp Lag Type	On	
38	Decel Time	50		77	Spd Lp Lead Freq	3.00	
39	Feedback Type	0 (Arm Volt)		78	Spd Loop Kp	4.40	

No.	Name	Default	Value	No.	Name	Default	Value
79	Tach Loss Angle	109		118	Trim Range	0%	
80	ADV SETUP 2	0		119	Trim Ref Source	0	
81	ADV SETUP 3	0		120	Trim Reference	0%	
82	ADV SETUP 4	0		121	OCL Enble Src	0 (Register)	
				126	Inertia Comp Reg	0	
83	ADV SETUP 5	0		127	Anlg In 1 Gain	1.000	
84	MOP Accel Time	5.0		128	Anlg In 1 Type	0 (O–10V)	
85	MOP Decel Time	5.0		129	Anlg In 1 Zero	0	
86	MOP Reset Enable	0		130	Anlg In 2 Gain	1.000	
87	Preset Speed 1	250		131	Anlg In 2 Zero	0	
88	Preset Speed 2	250		132	Anlg In 3 Gain	1.000	
89	Preset Speed 3	250		133	Anlg In 3 Type	1 (±10V)	
90	Ref 1 Source	0		134	Anlg In 3 Zero	0	
91	Ref 2 Source	1		135	Anlg In 4 Gain	1.00	
92	Jog Acc/Dec Time	3		136	Anlg In 4 Zero	0	
93	Jog Reference	250		137	Freq In Scale	250 kHz	
94	Jog Off Dly Time	1		138	Freq In Zero	2.0 kHz	
95	REF SETUP 2	0		144	Anlg Out 1 Gain	1.00	
96	REF SETUP 3	0		145	Anlg Out 1 Src	0 (Cur Lp Fdbk)	
97	REF SETUP 4	0		146	Anlg Out 1 Zero	0	
98	REF SETUP 5	0		147	Anlg Out 2 Gain	1.000	
99	Min Speed Bypass	0 (Off)		148	Anlg Out 2 Src	0 (Spd Lp Fdbk)	
100	Ref Ramp Bypass	0		149	Anlg Out 2 Zero	0	
101	Current Compound	0		150	Anlg Out 3 Gain	1.00	
102	Inertia Comp Src	0		151	Anlg Out 3 Src	0 (Cur Lp Fdbk)	
103	Monitor 1 Delay	10 seconds		152	Anlg Out 3 Type	0 (0 – 10V)	
104	Monitor 1 Source	1		153	Anlg Out 4 Gain	1.000	
105	Monitor 1 Level	10%		154	Anlg Out 4 Src	0 (Cur Lp Fsdk)	
106	Monitor 2 Delay	10 seconds		155	Dig Out 1 Src	0 (Monitor 1 Out)	
107	Monitor 2 Source	1		156	Dig Out 1 Type	0 (Normal Open)	
108	Monitor 2 Level	10%		157	Dig Out 2 Src	1 (Monitor 2 Out)	
109	Normal Inertia	1 seconds		158	Dig Out 2 Type	0 (Normal Open)	
110	Reverse Disable	0 (Off)		159	Freq Out Scale	250 kHz	
111	S-Curve Rounding	0%		160	Freq Out Src	14 (Zero)	
112	AutoTune Bridge	0 (Forward)		161	Freq Out Zero	2 kHz	
				166	Last Stop Cause	0	
113	AutoTune Fld Rng	1.00		167	Open SCR Sens	%	
114	AutoTune Stab	25		168	Open SCR Trip Pt	800	
115	Stop Mode Type	2 (Coast DB)		169	Phase Tst Delta	0 degrees	
116	Stop Speed Level	50		170	Phase Tst Bridge	0 (Forward)	
117	Trim Mode Type	0 (No Trim)		171	Armature Bridge	0 (Forward)	

No.	Name	Default	Value	No.	Name	Default	Value
172	Armature Delta	0		226	DATA IN A1	0	
173	Current Compound TP	0		227	DATA IN A2	0	
174	Field Delta	0		228	DATA IN B1	0	
175	Field Econ Active	0 (Not Active)		229	DATA IN B2	0	
176	Field Ref TP	0		230	DATA IN C1	0	
178	Future Use	0		231	DATA IN C2	0	
179	IR Comp TP	0		232	DATA IN D1	0	
180	J11 Tach V Scale	0		233	DATA IN D2	0	
181	J14 Tach V Range	0		234	DATA OUT A1	0	
182	J15 Reg Type	0		235	DATA OUT A2	0	
183	J18 Arm Fdbk Res	0		236	DATA OUT B1	0	
184	J20 Fld Loss Det	0		237	DATA OUT B2	0	
185	J21 Field Supply	0		238	DATA OUT C1	0	
186	Power Unit Type	0		239	DATA OUT C2	0	
187	Encoder Kit	0		240	DATA OUT D1	0	
188	Regulator SW Ver	0		241	DATA OUT D2	0	
189	Encoder Fdbk	0		247	PROCESS 1 PAR	5	
190	Logic Status	0		248	PROCESS 1 SCALE	1.00	
191	Drive Status	0		249	PROCESS 1 TEXT 1	86	
192	AC Line Period	0		250	PROCESS 1 TEXT 2	111	
193	AC Line Voltage	0		251	PROCESS 1 TEXT 3	108	
194	Analog Tach Fdbk	0		252	PROCESS 1 TEXT 4	116	
195	Exp I/O Dig In	0		253	PROCESS 1 TEXT 5	115	
196	Fault Reset	0		254	PROCESS 1 TEXT 6	32	
197	Alarm Reset	0		255	PROCESS 1 TEXT 7	32	
198	CPU Loading	0		256	PROCESS 1 TEXT 8	32	
199	Not Ready Cause	0					
200	SCANport Errors	0		257	PROCESS 2 PAR	6	
201	Run Mask	127		258	PROCESS 2 SCALE	1.00	
202	Direction Mask	126		259	PROCESS 2 TEXT 1	65	
203	Jog Mask	127		260	PROCESS 2 TEXT 2	109	
204	Reference Mask	127		261	PROCESS 2 TEXT 3	112	
205	Fault Reset Mask	127		262	PROCESS 2 TEXT 4	115	
206	MOP Mask	127		263	PROCESS 2 TEXT 5	32	
207	Logic Mask	127		264	PROCESS 2 TEXT 6	32	
208	Local Mask	127		265	PROCESS 2 TEXT 7	32	
214	Stop Owner	0		266	PROCESS 2 TEXT 8	32	
215	Run Owner	0		272	E–Fld Volts Adj	84	
216	Direction Owner	0		273	Fld Econ Delay	5	
217	Jog Owner	0		275	Fld Auto Weak	1	
218	Reference Owner	0		276	Fld Delta Hi Lim	130	
219	Flt Reset Owner	0		277	Fld Loss Level	60%	
220	MOP Owner	0		278	Fld Lp Lead Freq	1.0	
221	Local Owner	0		279	Fld Loop Kp	0.30	

No.	Name	Default	Value		No.	Name	Default	Value
280	Field Reference	4095			295	OCL Lead Freq	1.00	
281	FLD Loop K–Fdbk	1.00			296	OCL Pos Limit	100%	
282	Fld Weak Ld Freq	0.30			297	OCL Neg Limit	100%	
283	Field Weaken Kp	0.80			298	OCL Ramp Time	10.0 sec	
284	Fld Weaken Level	228			299	OCL Reference	0	
290	OCL Fdbk Source	Cur Lp Fdbk			300	OCL Ref Rounding	0%	
291	OCL LeadLag Freq	1.0			301	OCL Ref Source	Register	
292	OCL LeadLag Ratio	10			302	OCL Trim Range	0.0%	
293	OCL LeadLag Type	1			303	OCL Enable	Disabled	
294	OCL Kp	2.0						

Lifting Instructions

Introduction

This publication will guide you through the steps needed to properly lift and mount the following Drives on a vertical surface:

- 1397 DC Drives (60-600 HP)

ATTENTION: To guard against possible personal injury or equipment damage . . .

- Do Not allow any part of the Drive or lifting mechanism to make contact with electrically charged conductors or components.
- At no time should a person or their limbs be directly underneath the items being lifted.
- Do not subject the load to high rates of acceleration or deceleration.
- Inspect all lifting hardware for proper attachment before lifting Drive unit.

Lifting Component Ratings

All lifting equipment and lifting components (Hooks, bolts, lifts, slings, chains etc.) must have a minimum lifting capacity of 1,000 lb.

Drive Mounting

Perform the following steps to mount the Drive.
NOTE: Horizontal mounting is NOT permitted.

1. Check the hole pattern on the panel to which the Drive will be mounted. Refer to Figure 2 thru 5 for the correct pattern.
2. Insert, but DO NOT fully tighten three bolts in the top holes of the panel. Bolts must be fully threaded into the panel before hanging the Drive as shown in Figure 1.

Figure E.1
Mounting Bolt Engagement

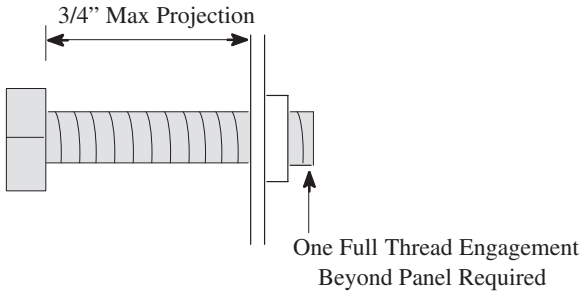


Figure E.2
Mounting Hole Pattern 60 HP Drives

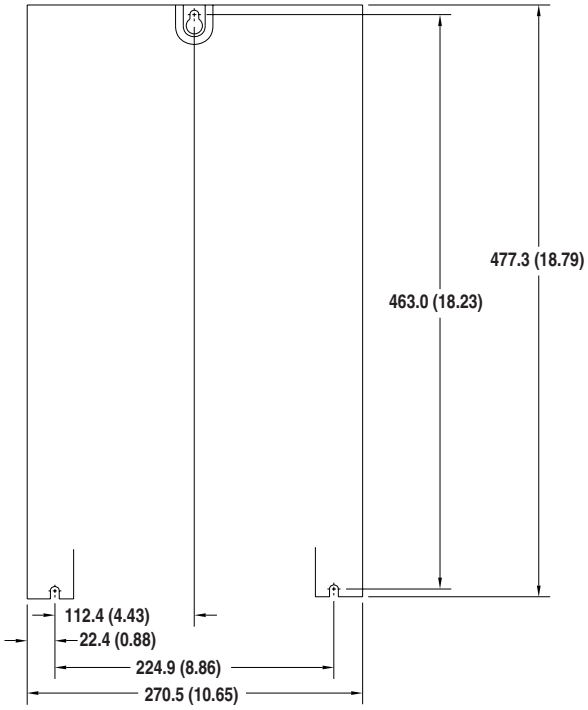


Figure E.3
Mounting Hole Pattern 150 HP Drives

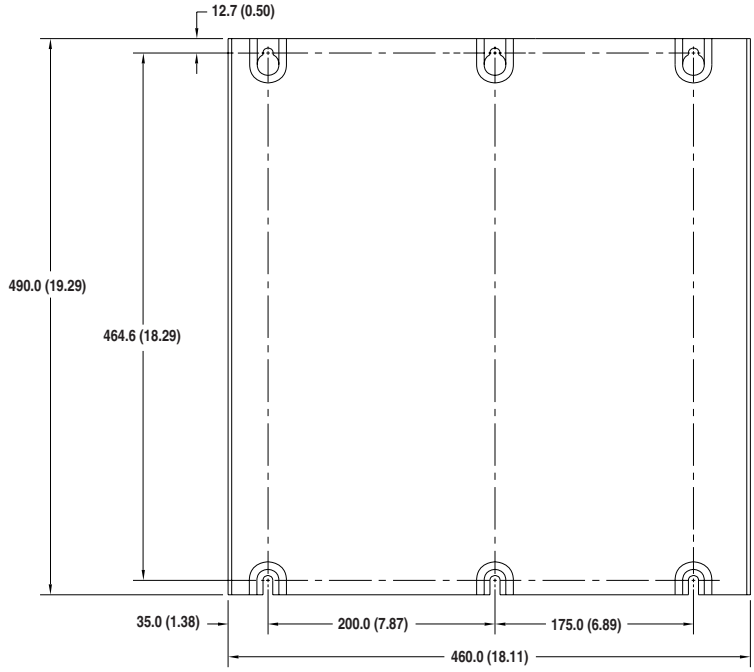


Figure E.4
Mounting Hole Pattern 300 HP Drives

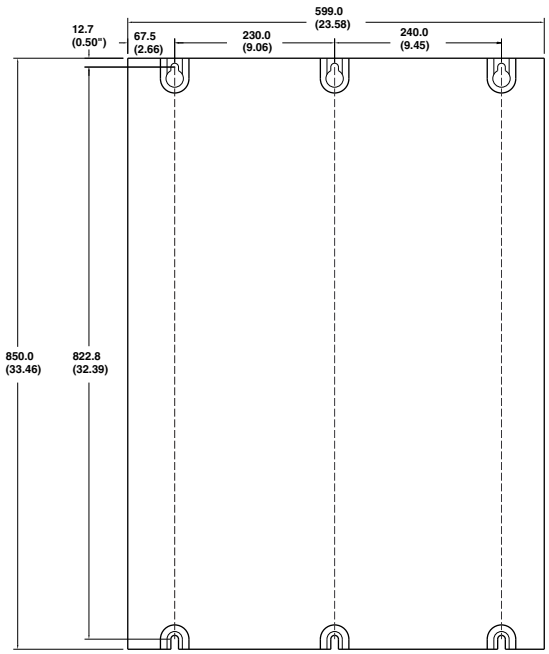
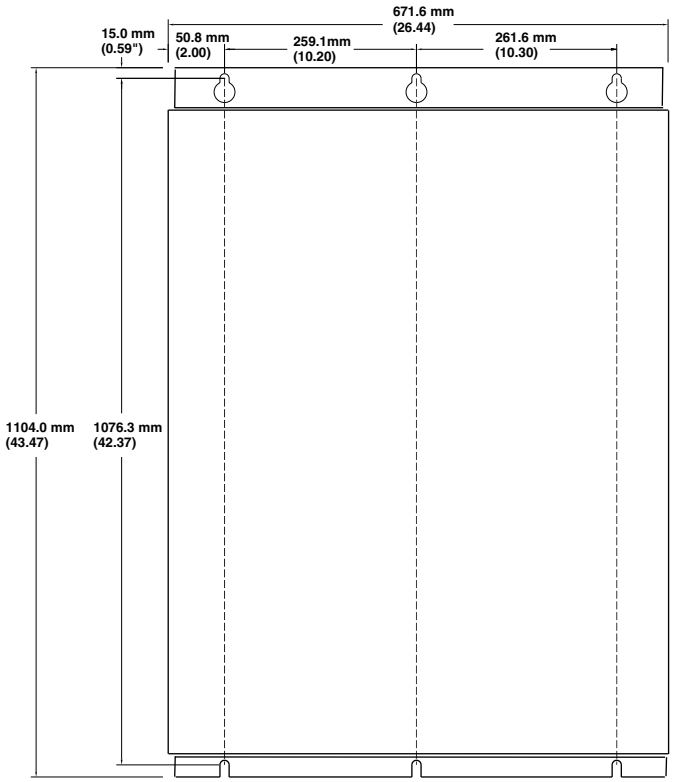
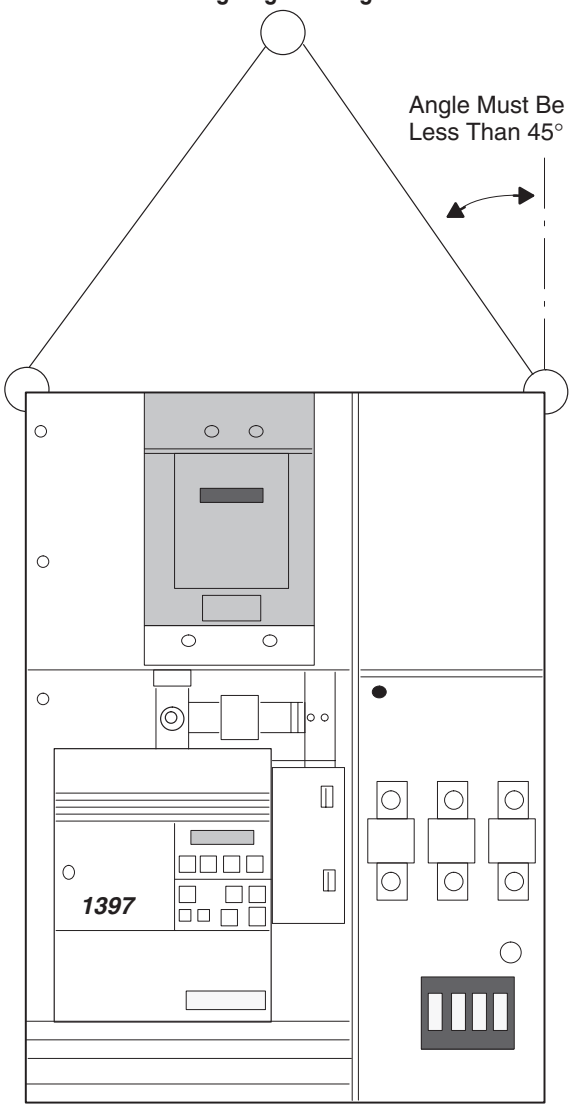


Figure E.5
Mounting Hole Pattern 600 HP Drives



3. Insert properly sized and rated lifting hooks into the top two 1" holes of the Drive chassis (Figure E6). To limit pull in forces on the Drive, the lifting devices connected to the hooks must be long enough to make the angle between the chain and a vertical line extending up from the cabinet edge less than 45 degrees as illustrated in Figure E6.
   NOTE: 60 HP and smaller Drives do not have lift holes in the top of the Drive chassis. If using hooks or lift eyes with these units, place them in the handholds on the side of the cabinet.
4. Lift Drive into place over the top (3) bolts. Verify that the bolt heads on the panel engage properly into the keyhole slots on the Drive.
5. Once the top bolts are properly seated, the bottom bolts can be installed and tightened.
6. Tighten all bolts to a torque of 22.6 N-m (200 lb.-in.).

Figure E.6
Lifting Angle Arrangement



Numbers

24V I/O Inputs, 4-26
24V Power Supply, 2-14

A

AC Line Connection, 2-19
AC Line Filter Model Numbers, B-3
AC Line Fuses, 2-25
AC Line Torque Recommendations, 2-24
Air Conditioning, C-2
Alarm Clearings, 6-2
Alarm Conditions, 6-7
Ambient Temperature Conditions, C-1
Analog Inputs, 1-8
Analog Outputs, 1-8
Analog Tachometer Polarity Checks, 4-33
Application Set-Up, 4-38
Autotune Execution, 4-37
Autotune Set-Up, 4-36

C

Cable Shielding Recommendations, 2-15
Catalog Numbering Convention, 1-3
Chassis Ground Connections, 2-14
Chassis Ground Hardware Torque, 2-14
Clearing a Fault, 6-2
Clearing an Alarm, 6-2
Configuring Field Supply, 4-8
Configuring the SCANport Controls, D-3
Control Connections, 2-30
Control System Ground, B-8
Control Transformer Tap Settings, 4-3
Control Wiring Procedure, 2-31
Cooling Airflow, 2-2

D

DC Armature Fuses, 2-25
Derating for High Altitude, C-2
DeviceNet Communications Module, D-8
Disconnect, 2-14
Drive Description, 1-9
Drive Ground Point Locations, 2-10
Drive Hardware Adjustments, 4-3
Drive Mounting Dimensions, 2-4
Dynamic Braking Kit, B-13

E

EMC − Benign Kits, B-12
EMC Compliance, B-1
EMC Requirements, B-1
Enclosure Mounting Minimum Clearances, 2-3
Encoder Pulse and AC Tachometer Kits, B-13
Enhanced Field Supply, 4-9
Environment, 2-1
External Wiring Guidelines, B-10

F

Fault Clearing, 6-2
Fault Description Display, 6-2
Fault Descriptions, 6-3
Field Supply Configuration, 4-8
Firmware Block Diagrams, A-1
Flex I/O Module, D-10

G

Ground System and Conduit Screen Termination, B-10

Grounding Procedures, 2-8

Grounding Requirements, B-8

H

Hidden Parameters, 5-100

HIM Description, 3-1

HIM Fault Display, 6-2

HIM Operation, 3-5

HIM Programming Steps, 3-6

I

Installation, 2-1

Internal Wiring Guidelines, B-11

I/O Inputs 24V, 4-26

J

Jumper and Adjustment Settings, 4-21

Jumper Settings, 4-20

L

Lifting Angle Arrangement, E-4

Lifting Component Ratings, E-1

Logic Command Format, D-12

Logic Inputs, 1-7

Logic Outputs, 1-7

Logic Status Format, D-12

Logic Status Parameter, D-1

Loss of Communications Fault, D-5

M

Motor and Feedback Polarity Checks, 4-29

Motor Ground Check, 4-6

Mounting, 2-1

Mounting Environment, 2-1

Mounting Hole Pattern, E-2

Mounting the AC Line Filter, B-4

Mounting the Drive, B-4

N

Numeric Parameter Table, 5−6

O

Options, 1-10

P

Parameter (Alphabetical), 5-97

Parameter Descriptions, 5-14

Parameter Groups, 5-2

Parameter Set-Up, 4-15

Pre-Power Checks, 4-6

Power - On Checks, 4-14

Power Ratings and Supply Capacity, 1-6

Power Wiring Procedure, 2-17

Pre-Power Checks, 4-6

Programming HIM, 3-6

Programming Parameters, 5-1

Pulse Encoder Polarity Checks, 4-34

R

Regulator Board Hardware Jumper Settings, 4-20

Regulator Board Input Signals, 2-31

Regulator Board Jumpers, 4-25

Remote I/O Communications Module, D-10

S

Safety Ground, 2-8

SCANport Configuration, D-3

SCANport I/O Image, D-5

SCANport Messages, D-11
Selecting an AC Line Filter , B-2
Selecting an AC Line Inductor , B-3
Serial Communications Module, D-9
Space Heaters, C-2
Specifications, 1-4
Status Display, 3-5
Start-Up and Adjustment, 4-1
System Power Ground, B-8

T

Terminal Strip Inputs, 2-32
Termination of Shielded Cables, B-9
Troubleshooting, 6-1

U

User Parameter Values, D-13

W

Wire Size, Type & Class, 2-15
Wiring Clearance, 2-14
Wiring Customer Interlocks, 2-36
Wiring the AC Line Filter, B-11
Wiring the AC Line Inductor, B-12
Wiring the Analog Input Circuits, 2-39
Wiring the Coast Stop Circuit, 2-34
Wiring the Control I/O Circuits, 2-38
Wiring the Fault/Alarm Reset Circuit, 2-37
Wiring the Motor, B-12
Wiring the Motor Thermostat/Brush Wear Circuits, 2-36

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